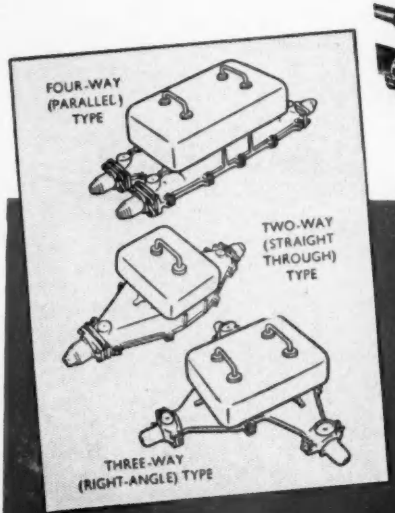
ELECTRICAL TIMES

THURSDAY
7 AUG.
1952
NINEPENCE

The large numbers of Henley Underground Disconnecting Boxes giving satisfactory service, at home and overseas, is proof of their reliability.

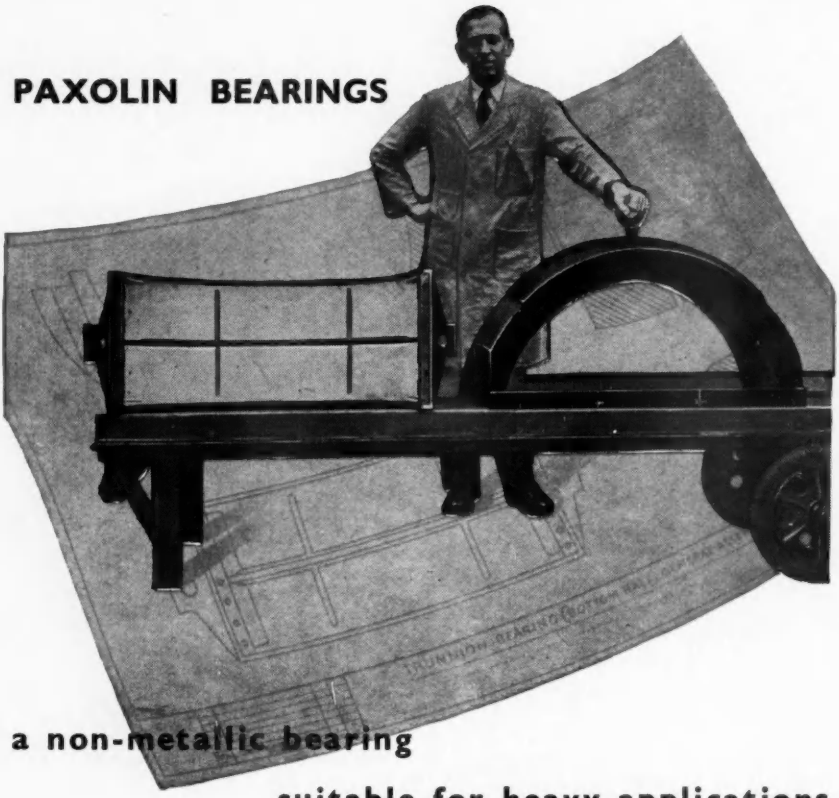
Full details of the wide range available are given in Henley Catalogue 27.



HENLEY

UNDERGROUND DISCONNECTING BOXES

PAXOLIN BEARINGS



a non-metallic bearing

suitable for heavy applications

Illustrated here is a large trunnion bearing we have produced for a ball mill. The bearing liners—nearly three feet in diameter—are of Paxolin laminate and fit into cast steel housings.

Paxolin bearings are shock resistant and with water lubrication, or immersed in water, can be used where grit or sand is unavoidable or where occasional but reliable functioning is required. Bore hole pump shafts, rolling mills, rudder and stern shaft bearings are a few examples of the many applications for Paxolin Bearings.

THE MICANITE & INSULATORS CO. LTD.

EMPIRE WORKS · BLACKHORSE LANE · LONDON · E.17

Manufacturers of Micanite (Built-up Mica Insulation). Fabricated and Processed Mica. Paxolin Laminated Materials. Panilax Laminated Materials and Mouldings. Empire Varnished Insulating Cloths and Tapes. High Voltage Bushings and Terminals. Distributors of Micoflex-Duratube Sleevings, Micoflex-Durasleeve (Plastics-covered flexible metal conduit) & Kenutuf Injection Mouldings (in most thermoplastics including P.V.C.).

m and i

'ENGLISH ELECTRIC'

h.r.c. fuse links

ASTA CERTIFIED

The Association of Short Circuit Testing Authorities (ASTA) issues Certificates of Rating for fuses giving satisfactory performance when tested in accordance with the appropriate clauses of British Standard 88.

The complete range of 'ENGLISH ELECTRIC' Type 'T' High Rupturing Capacity Non-Deteriorating Cartridge Fuse Links has been ASTA certified for Category of Duty 440AC4 to the 1939 edition of B.S.88 (the highest category at that time) and for Categories of Duty 440AC4 and 440AC5 representing 25 MVA and 35 MVA respectively to the 1947 edition of B.S.88.

RATING AMPS.	LIST NOS.	ASTA CERTIFICATE NUMBERS		
		B.S.88: 1939	B.S.88: 1947	
		440 AC 4	440 AC 4	440 AC 5
30	T1A30	617	1016	2074
60	T1S60	616	903	2022
100	TC100	615	932	2021
200	TF200	251	933	2033
300	TKF300	252	934	2032
400	TM400	629	935	2031
500	TT500	354	936	2025
800	TLT800	353	2098	2026

The ENGLISH ELECTRIC Company Limited

QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Fusegear Works: East Lancashire Road, Liverpool 10

Works: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

F.7

A

MINERVA
ELECTRICAL INSULATING VARNISHES

STOVING VARNISHES (Natural Resin Type)
STOVING VARNISHES (Synthetic Resin Type)
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AIR-DRYING VARNISHES
CLOTH VARNISHES
CORE-PLATE VARNISHES (Stoving and Air-Drying)
COPPER-WIRE ENAMELS (Oleo-resinous and Synthetic Types)
All the above are supplied in black & clear

ACID & HEAT RESISTING ENAMELS
Available in all colours
MICA BONDING VARNISHES
COIL STICKING VARNISHES
SLEEVING VARNISHES (Black, Clear and Colours)
CABLE LACQUERS (Non-flam., Cellulose Type and P.V.C.)
COMPOUNDS Various Types

Our Insulating Varnish Department includes research and testing laboratories: the service of specialists is available to any manager or engineer concerned with problems of insulating materials and their application.

All the materials listed conform to B.S. Specifications wherever applicable

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Sturdy Transformers are manufactured from 1kVA to 50kVA for all industrial applications and our technical service is always at your disposal.

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WITH 101 *USES*

IN its variety of forms, the Cressall steel jacketed unit heater is the solution to most heating problems. Let a Cressall Technical Expert discuss heating with you before you decide. He will be happy to help.

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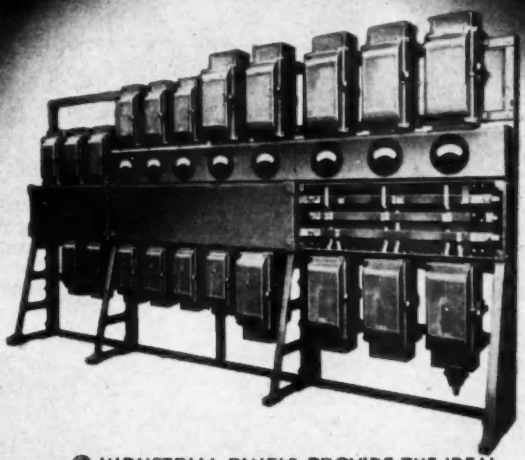
Telephone: ASTon Cross 2666 (3 lines)
Telegrams: "OHMIC Birmingham"



INDUSTRIAL PANELS PROVIDE THE IDEAL MAIN DISTRIBUTION FOR THEATRES, FACTORIES, HOSPITALS, HOTELS AND ALL PUBLIC BUILDINGS

INDUSTRIAL PANELS ENSURE THAT ALL SECTIONS OF AN INSTALLATION ARE UNDER ONE MAIN CONTROL

A SPECIAL TECHNICAL STAFF WILL ASSIST WHERE NECESSARY AND TENDERS WILLINGLY SUPPLIED TO YOUR OWN SPECIFICATION

BILL SWITCHGEAR LTD
ASTON LANE, PERRY BARR
BIRMINGHAM 20

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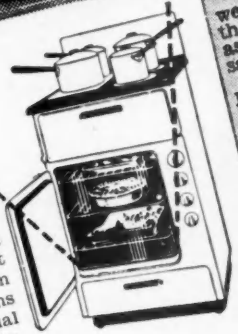
HEAD OFFICE.	61, PETER ST.	HEAD OFFICE.	HEAD OFFICE.	WOOD STREET.	CHURCH LANE.	HEAD OFFICE.

SEE what's cooking

through the glass door

Yes, you really *can* see what's cooking now! It's VISIBLE COOKING that makes Belling Electric Cookers so different and so popular — just look through the full size inner glass door and see exactly what's going on inside without losing heat or spoiling the food — it's all so easy and so economical and makes cooking a real pleasure.

At only £34.12.6 (no tax) the Belling 47AB costs no more than an ordinary cooker.



Full size inner glass door — it's armour plate, steam free and exclusive to Belling. Extra large oven with automatic heat control — just set it and leave it. Three Boiling Plates and Grill, large hot cupboard for plates and food — sparkling cream or white vitreous enamel. Hire Purchase terms available. Immediate delivery from your usual Electrical Shop or Showroom. If any difficulty, please write to Belling & Co., Ltd., Enfield, Middx.

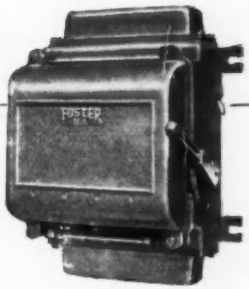
"Belling" visible cooking

It's no use trying to say that anything is easy to sell today; it isn't, but some things are easier than others — some cookers for instance. With its glass door and other exclusive features, the Belling 47AB has never stayed very long in your stock-room. Not only to keep up but to boost your sales (and ours), we are starting another very big advertising campaign in the national and provincial papers. This advertisement will be getting home 70,000,000 times during the next three months. Here's your big chance . . . If you can't supply your customer from stock, let us know and we'll send you one right away.

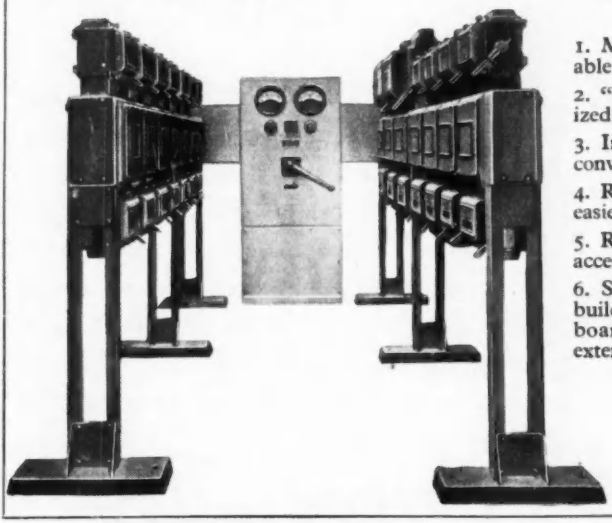
BELLING & CO. LTD., BRIDGE WORKS, ENFIELD, MIDDLESEX · HOWard 1212

CRC390

GREATER FLOOR SPACE MEANS GREATER PRODUCTIVE CAPACITY!



Valuable floor space can be permanently saved and productive capacity correspondingly increased through the special space-saving features of Lancashire Dynamo (previously Foster) Heavy Industrial Switchboards.
The Compact design of the gear keeps space requirements to a minimum which when added to the other engineering features outlined below makes Lancashire Dynamo Switchgear an ideal method of reliable and economic distribution of low tension electrical energy.



6 special features of Lancashire Dynamo Switchgear designed for practical efficiency.

1. Maximum floor space available through compact design.
2. "Unit-to-Unit" standardized flexible construction.
3. Integral floor pedestals for convenient position.
4. Removable carriers for easiest installation.
5. Removable interiors for accessibility and service.
6. Standardized component build-up of complete Switchboards simplifies service extensions and modifications.

Illustrated Catalogues are available on request.

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LANCASHIRE DYNAMO

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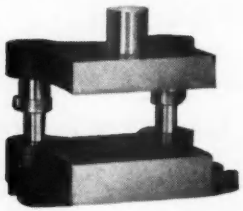
A 'Lancashire Dynamo' Company

swi/4

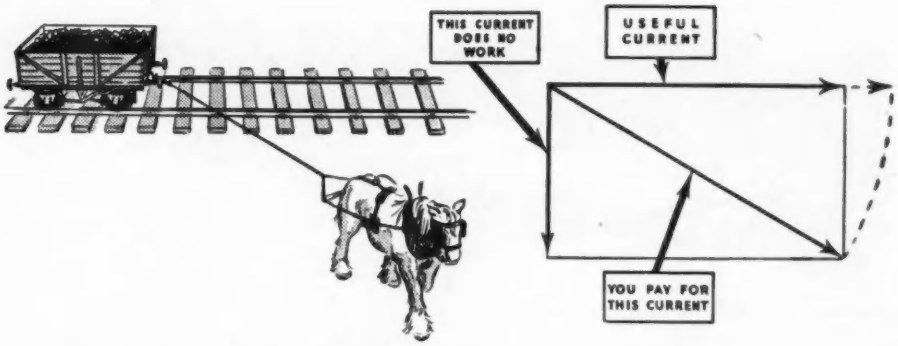
When the General digs his own slit trench

. . . things have come to a pretty pass. It is as distressing a sight as a toolmaker making a Press Tool Set. For General Snooks is paid a fabulous salary to win battles. Let him be free to plan them. 6968998 Private Snooks is far better equipped to dig and fight. Each to his proper job. The General to his strategy, the Private to his sanguinary shovel; the toolmaker to his intricate tools — and Press Tool Sets to Desoutter who specialise in them.

***It is quicker and cheaper to order your* PRESS TOOL SETS *from* Desoutter**



Desoutter Bros. Ltd., The Hyde, Hendon, London, N.W.9. Tel: Colindale 6346 (5 lines). 'Grams: Despnuco, Hyde, London.
CRC80

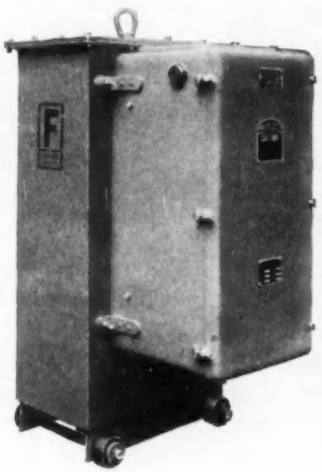


Wattless current does no useful work!

Much industrial electrical plant still operates at an unduly low "power-factor," and users are penalised for this undesirable condition in their electricity charges.

The "power-factor" of an industrial work-load can be improved to any desirable value by installing Ferranti Power Factor Correction Capacitors, and the capital cost can be recovered in savings in the cost of electrical energy, usually within one year.

Industrialists and other users concerned by rising electricity costs can profitably investigate this method of increasing the "earning capacity" of the electric energy consumed—Ferranti engineers will give advice and prepare schemes showing the substantial savings which are possible.



FERRANTI LTD

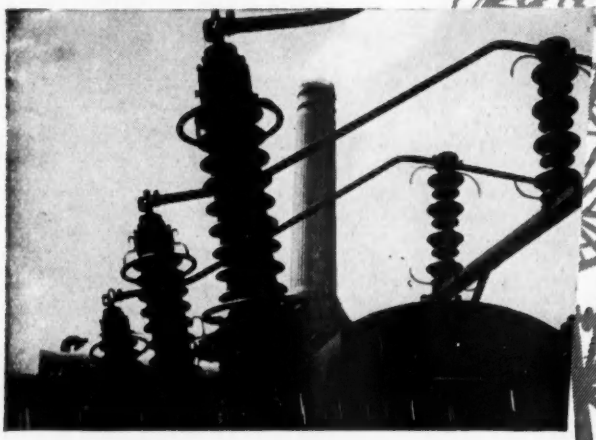
Power Factor Correction

CAPACITORS

FERRANTI LTD., HOLLINWOOD, LANCS. *London Office :* **KERN HOUSE, KINGSWAY. W.C.2.**

FT. 112A

P & G BATTERIES in the public service



P & G Batteries play an important part in maintaining the efficiency of Britain's giant grid system. In countless substations where the flow of energy is broken down to comply with local needs, there you will find P & G Batteries operating vital switchgear or providing emergency lighting should the mains supply fail. The P & G service extends into many spheres, a natural result of 60 years' experience of battery manufacture and development. In round terms here it is. **1.** *Technical Advice and Specifications.* **2.** *Complete equipment and installation.* **3.** *Regular inspection and report.* A discussion of your scheme may help. We are always ready to agree that two heads are better than one.

2 *heads are better than* **1**

PRITCHETT & GOLD and EPS Co. LTD
50 GROSVENOR GARDENS · LONDON · SW1

PG11

Batteries for Switch Closing, Switch Tripping, Emergency Lighting, Supervisory Control, Telephones, Supply to Auxiliaries

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Preference
REQUISITION TO PURCHASING DEPARTMENT
THE FOLLOWING INSTRUMENTS ARE REQUIRED URGENTLY
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REASONS FOR PREFERENCE
The present el meter represents the result of 20 years' continuous research. During this period improvements have been made from time to time and, whilst retaining the proved basic design, further modifications have now been made to attain unparalleled performance under all conditions, the latest refinements are improved vernier adjustment and complete compensation for temperature changes.
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METERS
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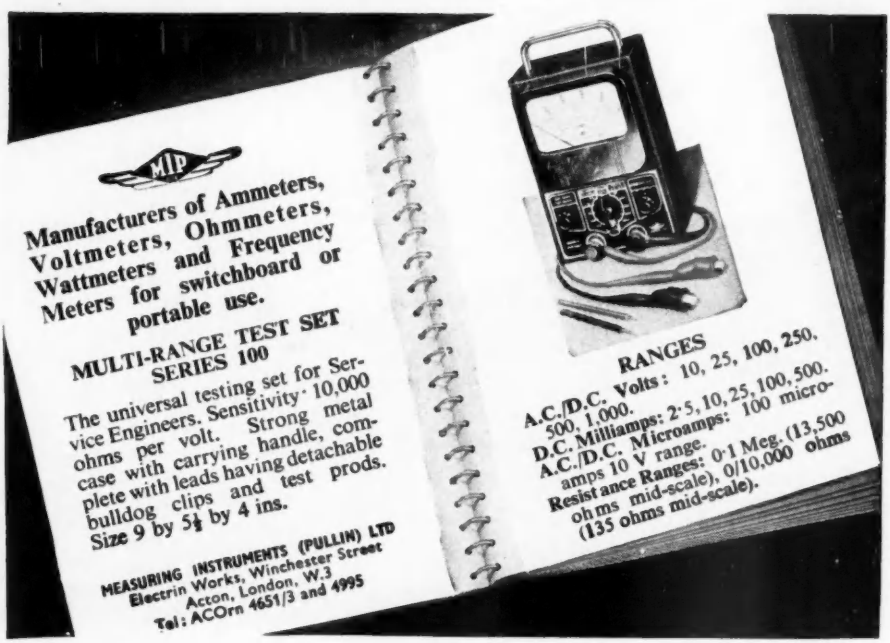
In association with BRYCE ELECTRIC CONSTRUCTION CO. LTD.
Branches at BIRMINGHAM, BRISTOL, CARDIFF, MANCHESTER, NEWCASTLE, SHEFFIELD.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Manufacturers of Ammeters, Voltmeters, Ohmmeters, Wattmeters and Frequency Meters for switchboard or portable use.
MULTI-RANGE TEST SET SERIES 100
The universal testing set for Service Engineers. Sensitivity 10,000 ohms per volt. Strong metal case with carrying handle, complete with leads having detachable bulldog clips and test prods. Size 9 by 5½ by 4 ins.
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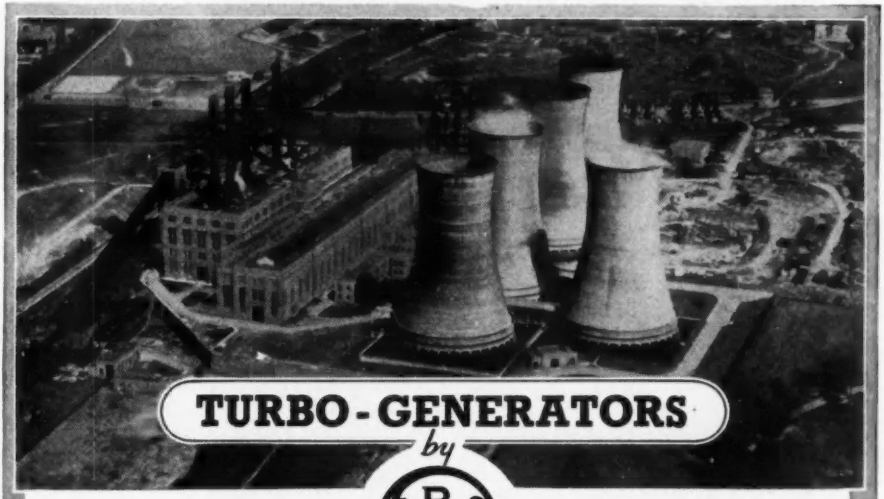
D.C. Milliamps: 2·5, 10, 25, 100, 500.
A.C./D.C. Microamps: 100 microamps 10 V range.
Resistance Ranges: 0·1 Meg. (13,500 ohms mid-scale), 0/10,000 ohms (135 ohms mid-scale).

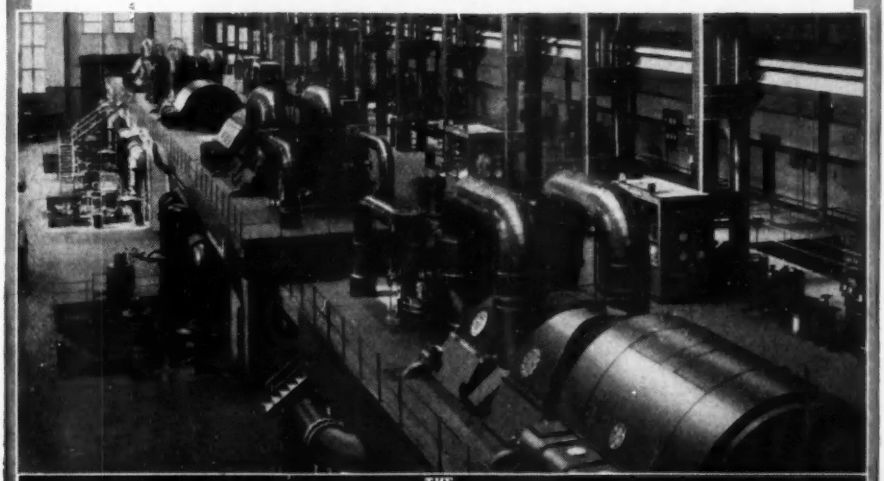


TURBO-GENERATORS

by

B T-H

Power stations throughout the world are equipped with steam turbines and generators made by BTH, who hold a leading position as designers and manufacturers of some of the largest machines installed. — At the Walsall Station of the British Electricity Authority, six BTH 30,000-kW. turbo-alternators are installed or on order making a total generating capacity of 180,000 kW.



THE

BRITISH THOMSON-HOUSTON

COMPANY LIMITED, RUGBY, ENGLAND

Member of the AEI group of companies

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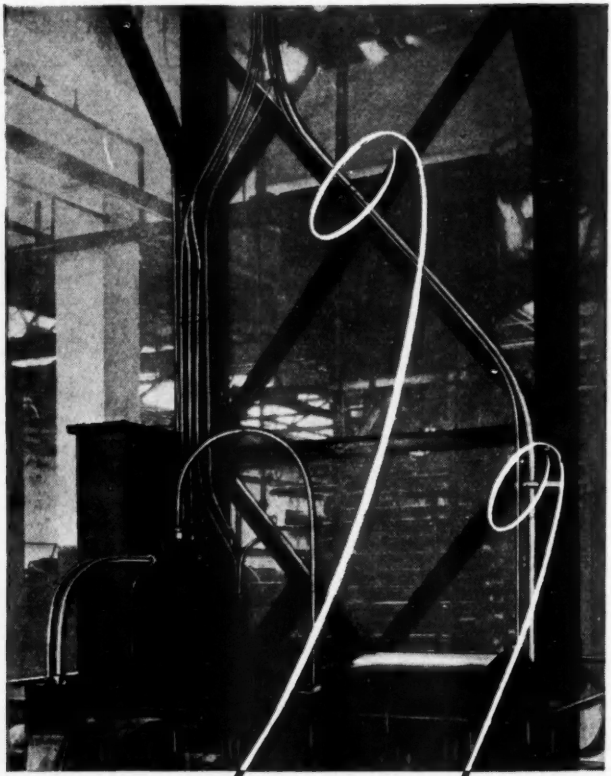

One! Two!

. . . it's surprising how few

. . . supports are required for J. & P. Aluminium Sheathed Cables. The lightness and strength of the aluminium sheath greatly facilitates erection and reduces cost considerably.

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The mark that means that "little more" in quality

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FOR EVERY PURPOSE

CREOSOTING
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TIMBER IN ANY FORM

'Æ' Super-nickel now

'KUNIFER' 30

Users of condenser tubes are familiar with the description 'Æ' Super-nickel applied to 70/30 cupro-nickel tubes made by the Metals Division of Imperial Chemical Industries Ltd. Keeping in the forefront of development, I.C.I. have for a number of years made a practice of supplying these tubes with a nominal 68% copper content and additions of iron and manganese.

The registered trade name, 'Kunifer,' will in future cover all I.C.I. cupro-nickel alloys containing iron and manganese. The nickel content of each alloy will be indicated by the number following the word 'Kunifer'. Accordingly, nominal 70/30 cupro-nickel condenser tubes to latest British Admiralty requirements will be known as 'Kunifer' 30 condenser tubes.

Copper-nickel-iron alloys containing 10% and 5% nickel, hitherto known simply as 'Kunifer', will now be designated 'Kunifer' 10 and 'Kunifer' 5.

'KUNIFER' 30 for condenser tubes

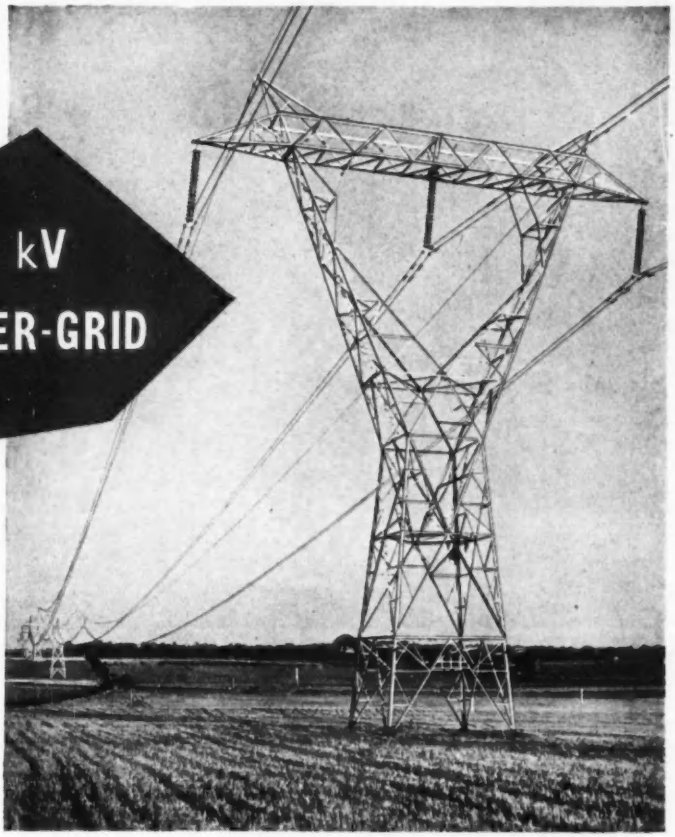
'KUNIFER' 10 for sugar tubes and general purposes

'KUNIFER' 5 for sea water trunking

IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1

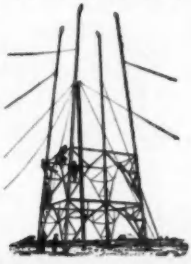
ICI

M247



Supplied and erected by the BICC GROUP

First section of the British Electricity Authority's new 275 kV Super-Grid is now completed. Over twenty miles long, it runs from Staythorpe power station to Barnby Moor, Nottinghamshire, and is the first 275 kV overhead line in the country. Supply and erection were undertaken by the BICC Group—who also constructed over half of the main lines in the present 132 kV Grid System.



B.I. Callender's

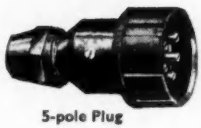
OVERHEAD TRANSMISSION

BRITISH INSULATED CALLENDER'S CABLES LIMITED
NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

REGD. TRADE MARK
NIPHAN

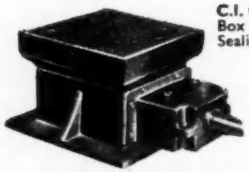
WEATHERPROOF METAL-CLAD PLUGS
SOCKETS, SWITCH PLUGS, ETC.
for all electrical purposes

5/300 amp. 250/500 volt


5-pole Plug

Plain Socket

Plug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Single-pole
Flange Plug
and Cover

C.I. Terminal Socket & Cover

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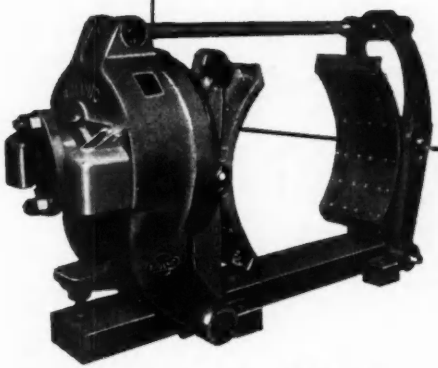
IGRANIC
MAGNETIC DEVICES. TYPE 'M' BRAKE.



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(OR A.C. WITH RECTIFIER)
EMBODYING DIRECT ACTION
MECHANISM ELIMINATING ALL
TOGGLES

For motors up to 350 h.p. using brake drums 8 ins. to 30 ins. diameter.

OUTSTANDING FEATURES

- Low head room.
- Bearings for hand release lever.
- 180° effective Braking surface: short brakeshoe stroke.
- Nickel-Chrome steel bushes limit wear and lengthen life of bearings.
- Long bearings at all points assure years of service. Main bearings fitted with grease nipples.

Full particulars of this Brake and other Igranic Magnetic Devices can be obtained upon application to Publicity Dept., Bedford, or any branch office

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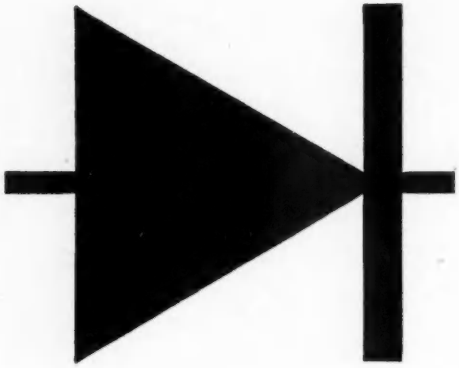
IGRANIC ELECTRIC COMPANY LIMITED



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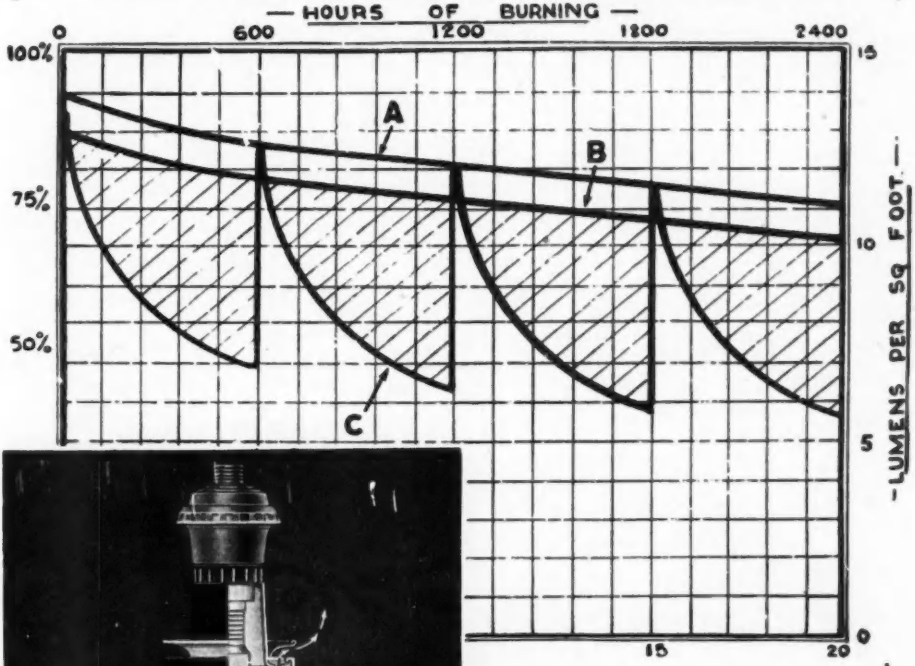

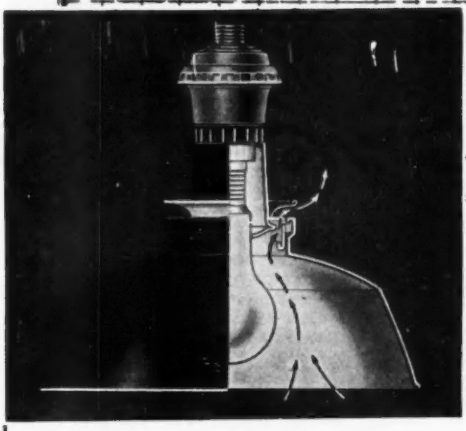

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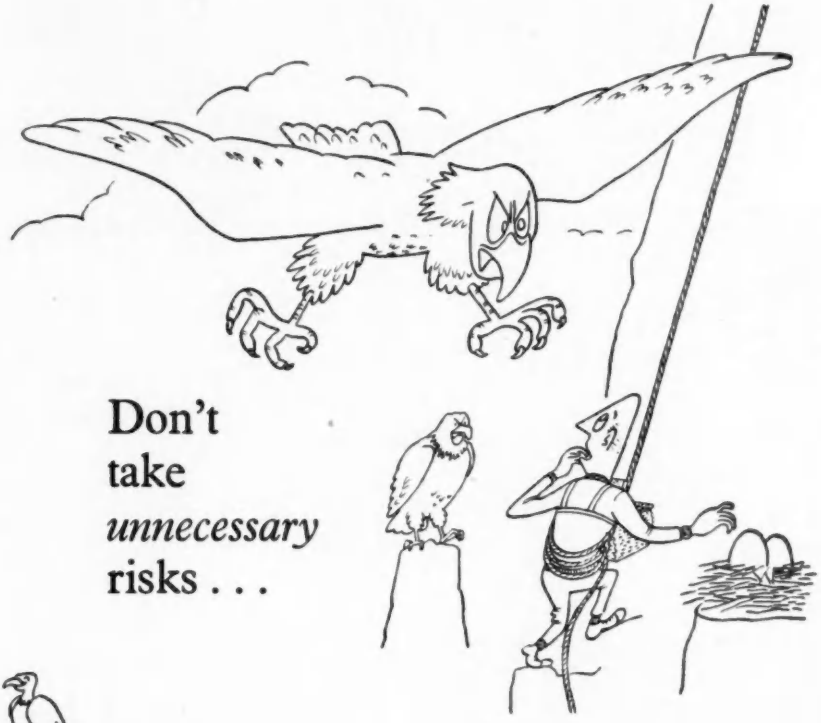

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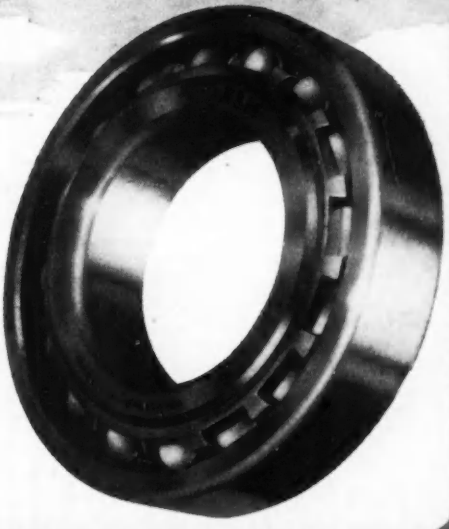

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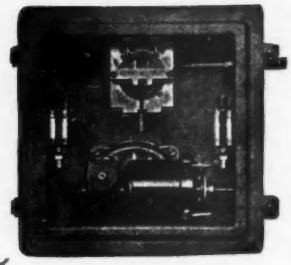

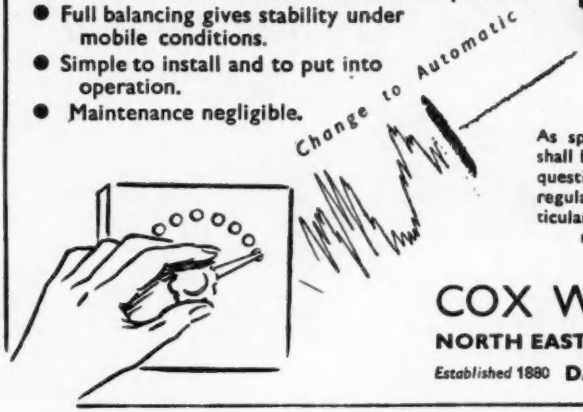

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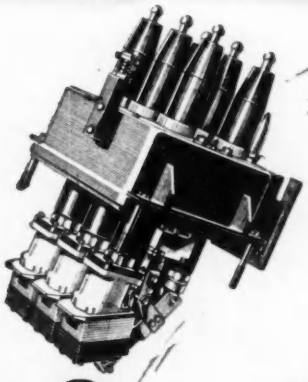

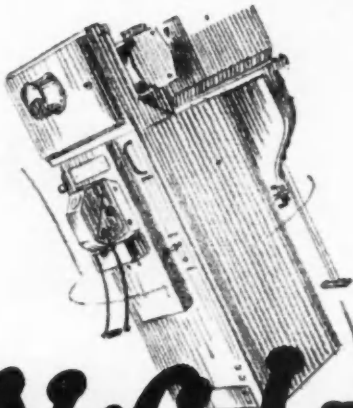

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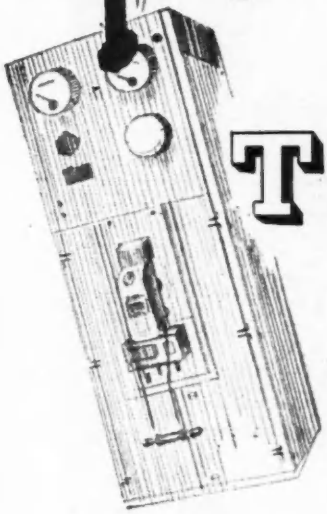

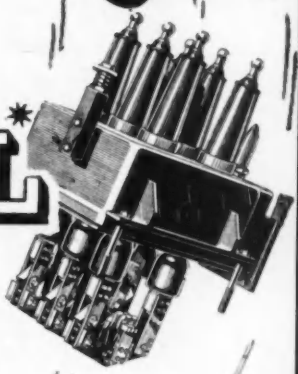

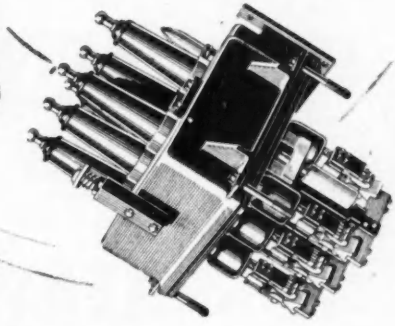

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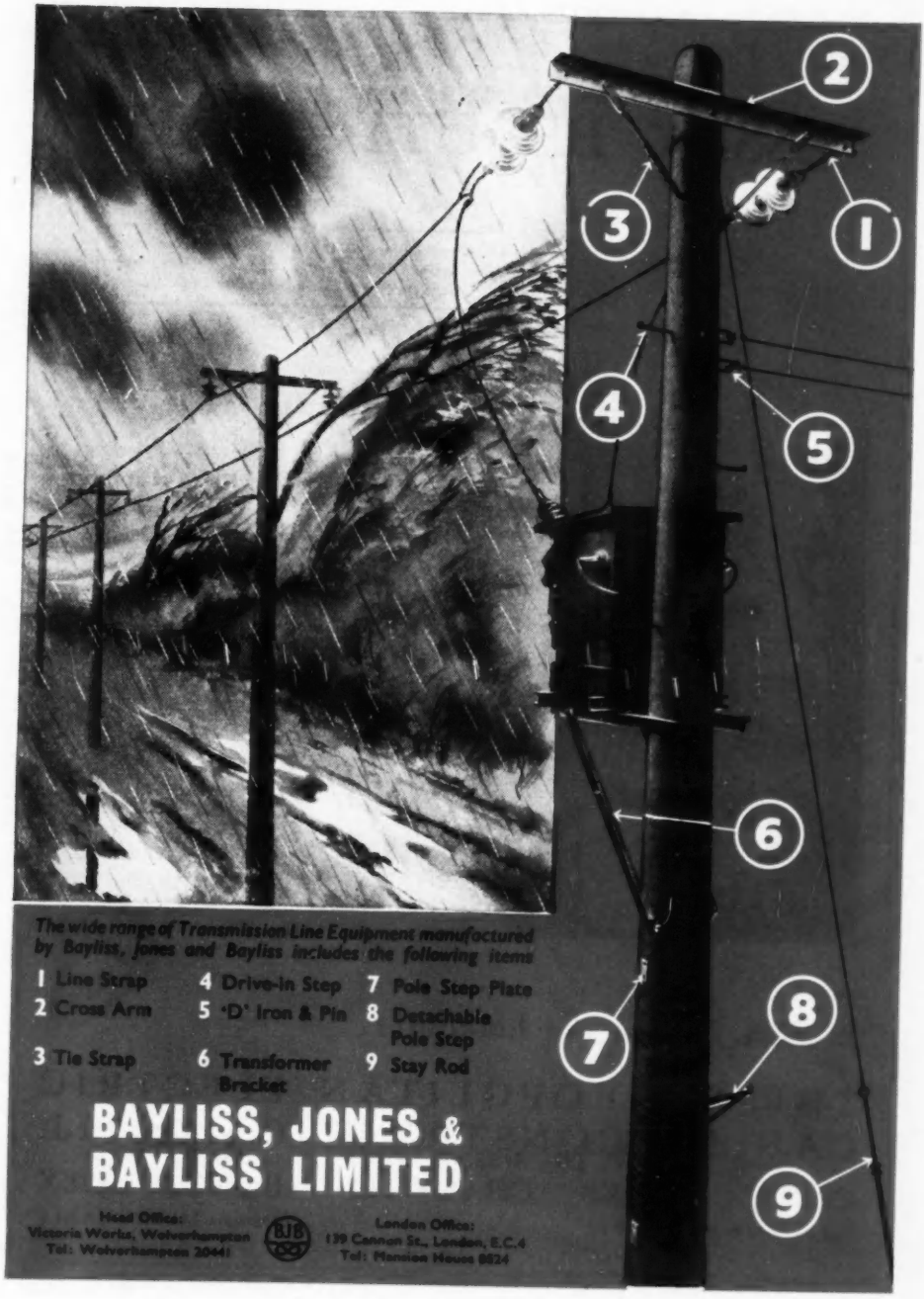

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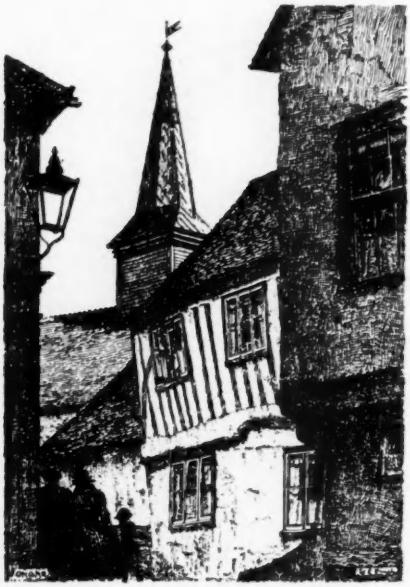

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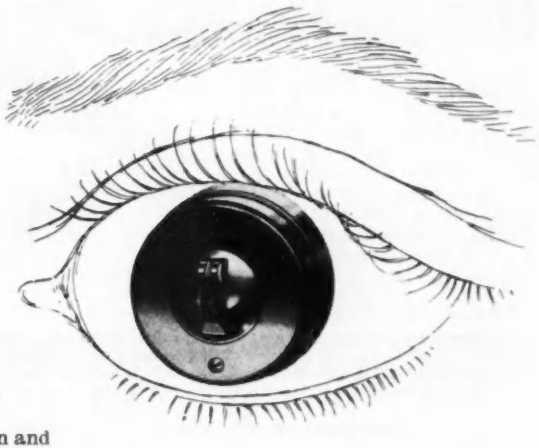

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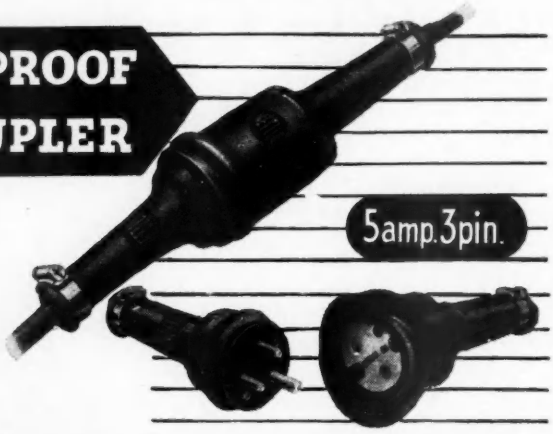

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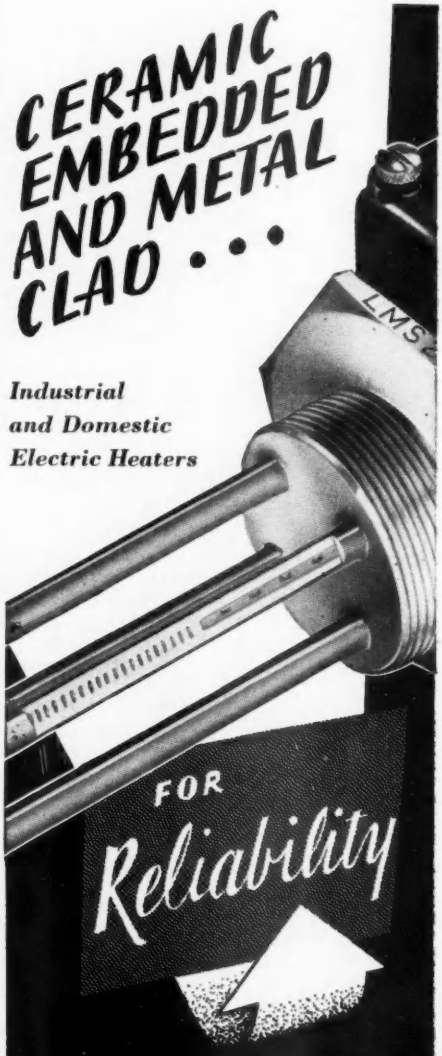

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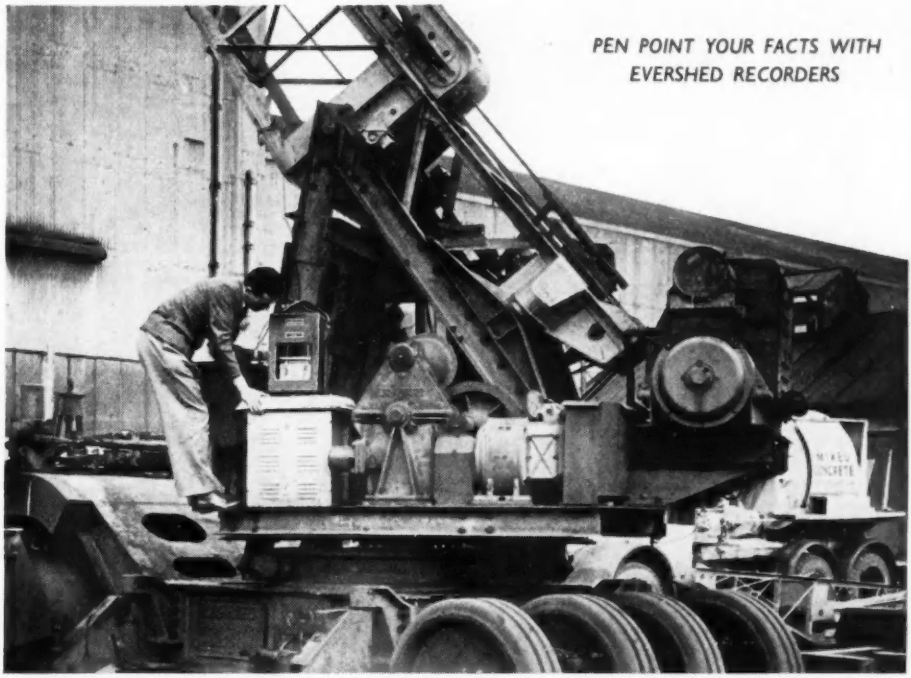

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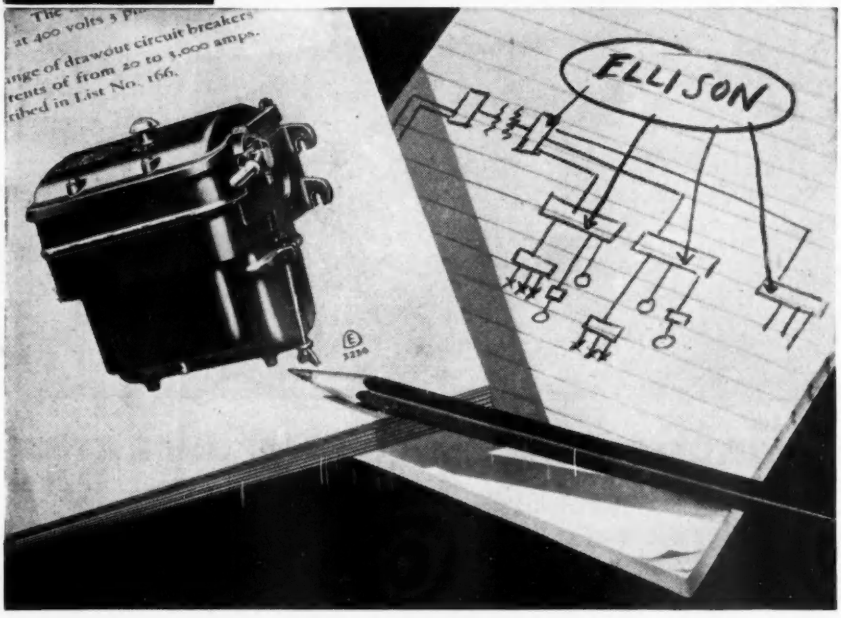

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Vol. 122 No. 3170 THURSDAY, 7 AUGUST, 1952

PUBLISHED EVERY THURSDAY

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ELECTRIC CONSTRUCTION BOOSTS GAS AT BIRMINGHAM

The illustration is reproduced by permission of
WEST MIDLANDS GAS BOARD
J. E. WAKEFORD, Esq.
M.B.E., M.Inst.Gas E., M.Inst.F.
Divisional Manager.

This Electric Construction motor driving a booster at the Washwood Heath plant of the West Midland Gas Board (Birmingham District) is a 460 B.H.P. fully compensated D.C. machine with a speed range of 750/1750 R.P.M. It is pressure-ventilated from separate motor-driven fans.
The control gear for this motor and the rectifier which supplies it are of E.C.C. make.

E C C

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Editorial

AT THE HELM

THE reappointments to the Central Authority of the B.E.A. which the Minister of Fuel and Power announced last week, will give general satisfaction to most electrical engineers. Lord Citrine, Sir John Hacking, and Sir Henry Self have formed a successful and increasingly confident team at the head of this great industry's affairs, and it is well that they are to be kept together to guide their charge through the second stage of its growth in a new form. They will be supported by much the same company as before, though many will sympathise with Mr. Bussey in that ill-health has caused him to seek a less onerous position of service to the industry. Above all, the departure of Sir William Walker from the active electrical scene, in which he has played an outstanding part for so many years, is an occasion for general regret. Only a few months ago, at Bournemouth, Sir William showed how strongly there still glows within him the fighting spirit which has always inspired his enthusiasm for the electrical case. His story stands as an example to those coming afresh to the leadership of the industry, to whom all will accord a ready welcome.

BRIEFING FOR CONSULTATION

THAT feature of modern industrial relations, joint consultation, is nowhere more necessary than in the large nationalised organisations. Yet it can only be effective if used against a background of understanding between management and man, and joint consultation itself must be one of the major means of achieving that better comprehension. How far available channels of communication have been effective to this end in the case of coal mining, is studied in an Acton Society Trust paper published last week, "The Worker's Point of View." Those whose faith in industrial peace and discipline is placed in a higher appreciation by workers of the background of managerial decision must find the story told in this booklet most disappointing, for it is one long chronicle of omission and failure. Fortunately in the electrical industry conditions are not so bad. The stronger leavening of men of higher educational standard, coupled with a less unfortunate industrial history, provides a more favourable starting point. On top of this, better liaison is provided at regional levels than appears to be the case in coal mining. All these lead to greater mutual understanding, but none the less there is no room for complacency, since the difference is one only of degree; the same factors are as certainly at work in the supply industry. Consequently there is much to learn from this study of the worker's point of view, which is facilitated by the sharp focus which conditions in coal mining presents.

ADVENT OF THE GAS TURBINE

IN the years immediately following the war, the gas turbine was hailed in Great Britain as one of the most remarkable inventions of the modern age. Its comparatively high efficiency, flexibility of operation, basic simplicity of design, and high power/weight ratio, led many people to believe that here was a prime mover with undoubted future possibilities. This initial outburst of enthusiasm was followed by a period of comparative quiet, during which engineers and scientists engaged in gas turbine development had to transmute the short-lived aircraft unit into a gas turbine with the long life required for electric power generation. This interim period seems to be coming to an end, and several machines for land and marine use have reached, or are reaching, their final stages of construction. Although the firms engaged in this work are justifiably cautious about making claims in advance, there is a growing feeling of optimism. From those few units, mostly in the 500 to 3,600 h.p. range, which we have seen, the

initial promise has been amply justified. It now remains to see if the larger sets up to 15,000 h.p. now nearing installation will perform as well.

ENTERPRISE AND ATOM

DEVELOPMENTS in nuclear energy are so clothed in secrecy engendered by security considerations that at first sight unsponsored industrial intervention in the work of developing practical atomic power sources might appear to have no place. Yet reports from overseas indicate that there the problem is being probed further with some degree of success. In the United States, at least four groups of manufacturers and supply authorities have emerged from a study of the basic economics of nuclear energy utilisation, sufficiently optimistic to wish to proceed further, if they are granted the right to use the necessary secret information. From Europe also comes news of a university-co-ordinated research project into the design of nuclear power plant which is being carried out by three industrial concerns. How does this country compare with this picture? It may be significant that Dr. Forrest of the B.E.A., in his paper at the recent B.E.P. Convention, expressed doubt concerning the sufficiency of the effort being made here. Although Harwell has already announced various projects as under consideration, he advocated a joint attack by a body representing electrical plant manufacturers, the supply industry, and A.E.R.E. Such a plan would reassure many who fear missed opportunities in the concentration of research work entirely in Government hands.

SAFER SUPPLY UNDERGROUND

IN the rugged conditions inseparable from coal mining practice, trailing cables supplying electrical machinery are inevitably a safety hazard meriting close attention. In their annual reports successive Electrical Inspectors of Mines have constantly stressed their danger, and at the same time recommended the answering safeguard which cable makers have developed: the use of screened cables in conjunction with adequate leakage protection. Some measure of the progress that has been made in this campaign is given in the most recent of these reports, which presents the first comprehensive collection of figures on the subject to become officially available since the Ministry of Fuel and Power's census in 1943. The story revealed is reassuring. While there had been a 50 per cent increase by 1950 in the total number of flexible cables in use for supplying coal-cutters and conveyors, the proportion of unscreened cables amongst them had fallen from two-fifths to less than one-seventieth. While the existence of any unscreened cable at all on this work is to be deprecated, the figures reveal progress on which the N.C.B. can justly pride itself.

PLEDGE FOR THE FUTURE

ELECTRICAL engineering has, since its earliest days, been firmly based on scientific principles. Many manufacturers have by their research activities kept well filled the pool of fundamental ideas available for commercial exploitation. With acknowledgement on every side that the prosperity of the country is dependent today upon our successfully selling ideas and quality, it is more important than ever that this practice should be continued and extended. While inaugurating last week a new industrial laboratory, itself a witness to industry's activity in this direction, Sir Ben Lockspeiser, Secretary of D.S.I.R. was most insistent on this point. He described it, in a helpful phrase, as "maintaining scientific capital". When complicated technical apparatus was necessary for production test purposes, he suggested, then some provision should always be made for its occasional use in more fundamental investigations. Though this principle is honoured in many concerns, it is certain that there are a number of others, particularly amongst medium sized and small establishments, which adopt a less enlightened attitude. The manufacturers would benefit both themselves and the industry as a whole by allowing their engineers an opportunity for occasional adventure towards the boundaries of knowledge of their subject.

Meteor

TEMPERATURE TESTS on Transformers

Methods of obtaining final temperature rise from a short-time heat run

by H. E. GREEN, B.Sc.(Eng.), A.M.I.E.E.

AT various times, proposals have been put forward for the estimation of the final temperature rise of a transformer from data obtained from a short time heat run. Such tests save both time and electrical energy, the advantage of which is obvious.

Assuming that a transformer is a homogeneous body, that the loss is constant, that the rate of heat transfer to the cooling medium is directly proportional to the temperature rise and that the temperature of the cooling medium is constant, then the heating curve is expressed by the differential equation:

$$\theta = \theta_f - \tau \frac{d\theta}{dt} \quad \text{.....equation (1)}$$

or, in its integral form:

$$\theta = \theta_f\left(1 - e^{-\frac{t}{\tau}}\right) \quad \text{.....equation (2)}$$

where:

θ = the temperature rise after time t

θ_f = the final temperature rise

and τ = the time constant.

The time constant is defined as the time the transformer would take to reach the final temperature θ_f if no heat were dissipated. (Since τ is proportional to the final temperature rise and inversely proportional to the loss, it is unfortunate that the word "constant" is used in this expression, and some authors have used the expression "time unit" or "time interval," especially in cases where the heating curve does not follow the simple law as given in equations 1 and 2.)

Early Methods

The earliest methods of estimating the final temperature rise from the short time heat run used a purely mathematical approach to this problem, assuming that the test figures followed exactly the theoretical curve. There are several well-known formulae, for example: if θ_1 θ_2 and θ_3 are the temperature rises at any part of the heating curve such that the time from θ_1 to θ_2 is equal to the time from θ_2 to θ_3, then:

$$\theta_f = \frac{\theta_2^2 - \theta_1\theta_3}{2\theta_2 - \theta_3 - \theta_1} \quad \text{.....equation (3)}$$

When $\theta_1 = 0$ i.e. at the start of the heat run, this equation becomes:

$$\theta_f = \frac{\theta_2^2}{2\theta_2 - \theta_3} \quad \text{.....equation (4)}$$

Later proposals for estimating the final temperature rise from the short time heat run employ graphical methods.

It will be seen from equation 1 that if $d\theta/dt$ (the rate of rise of temperature) is plotted against θ, this will give a straight line which cuts the temperature axis at $\theta = \theta_f$ as shown in Figure 2. The value of θ_f can thus be extrapolated from the short time data. This method is given in the V.D.E. specification for transformers (Reference 1) where it is recom-

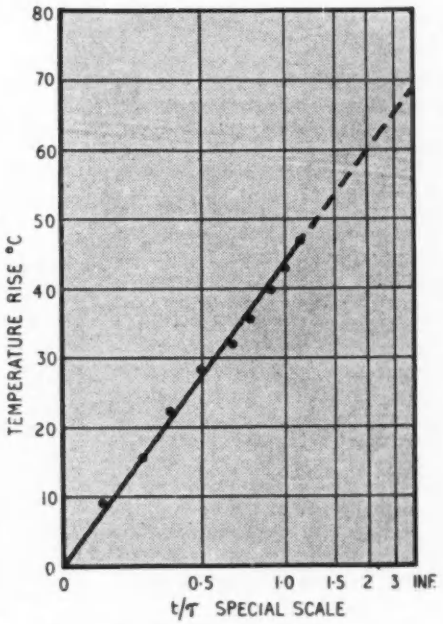

Fig. 1. Method using special scales

TABLE GIVING VALUES OF $\left(1-e^{-\frac{t}{\tau}}\right)$ FOR DIFFERENT VALUES OF t/τ FROM 0 to 5·9

	0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
0	0	0·095	0·181	0·259	0·330	0·393	0·451	0·503	0·551	0·593
1	0·632	0·667	0·699	0·727	0·753	0·777	0·798	0·817	0·835	0·850
2	0·865	0·878	0·889	0·900	0·909	0·918	0·926	0·933	0·939	0·945
3	0·950	0·955	0·959	0·963	0·967	0·970	0·973	0·975	0·978	0·980
4	0·982	0·983	0·985	0·986	0·988	0·989	0·990	0·991	0·992	0·993
5	0·993	0·994	0·994	0·995	0·995	0·996	0·996	0·997	0·997	0·997

mended on the grounds that the measured temperature rise fluctuates irregularly towards the end of the test owing to changes in the temperature of the cooling medium.

Extrapolation of a curve which is known to be theoretically a straight line is comparatively easy, but this last method has the disadvantage that difficulty may be encountered in determining sufficiently accurately the value of $d\theta/dt$. Extrapolation of the exponential heating curve is extremely difficult, if not impossible, but if means can be devised to effect a mathematical transformation of the curve into a straight line, then extrapolation becomes relatively easy. If instead of plotting θ against t, θ is plotted against u, where $u=\left(1-e^{-\frac{t}{\tau}}\right)$ we get a straight line: $\theta=\theta_f . u$

Plotting of this graph is facilitated by the use of special graph paper (Ref. 2, 3) as shown in skeleton form in Fig. 1. This special graph paper is usually called "transient heating graph paper."

As far as the author is aware, this special graph paper is not commercially available; a table is therefore given showing the values of $\left(1-e^{-\frac{t}{\tau}}\right)$ for different values of t/τ from which it may be drawn.

This requires knowledge of the time constant, and it must be pointed out that as the time constant is proportional to the final temperature rise it must be found by trial and error, taking the guaranteed, or calculated temperature rise for the first approximation. Formulae for the calculation of the time constant are given by several authors (Refs. 3-11 inclusive).

The time constant can also be found by trial and error from the heating curve, a first approximation being obtained from the guaranteed or calculated temperature rise and the initial rate of rise of temperature plotted on linear graph paper. (When $t=0$, $d\theta/dt=\theta_f/\tau$.)

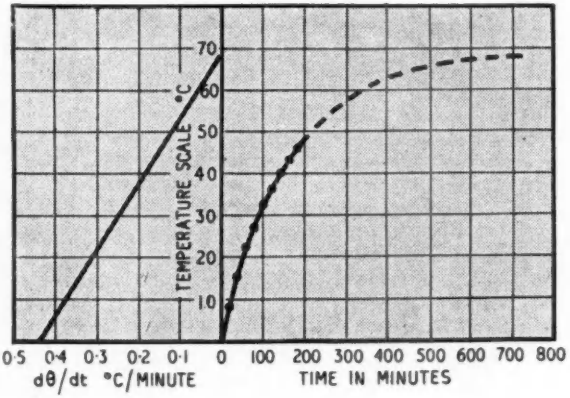

Fig. 2. Conventional methods are shown here of extrapolation

Assumptions

As already mentioned, equations 1 and 2 are based on several assumptions. It is beyond the scope of this article to discuss these, but two points may be mentioned.

A transformer is not a homogeneous body, but is constructed of many different materials having different thermal properties; this is taken into account empirically in the various formulae for the time constant.

The rate of heat transfer to the cooling medium is proportional to the temperature rise only in the case of forced cooling. In the case of natural convection in air it is usually taken as proportional to the $5/4^{th}$ power of the temperature rise, and it has been proposed (Ref. 12) that estimation of the final temperature rise from the short time heat run should be obtained by plotting $d\theta/dt$ against $\theta^{1\cdot25}$ in this case. (This is facilitated by the use of special graph paper divided according to the $5/4^{th}$ power in one direction and linearly in the other.) Many authorities, however, consider that the exponential heating curve is sufficiently accurate for practical purposes.

So far, the relation between the winding temperature and the oil temperature in the case

of an oil-cooled transformer has not been mentioned. The time constant of the windings relative to the oil is much less than the time constant of the whole transformer (based on the top oil temperature) relative to the cooling medium. The winding temperature gradient will therefore quickly reach its final value. (The winding temperature gradient is the amount by which the average winding temperature exceeds the average oil temperature.)

In this connection it is interesting to study the heat transfer between the core, windings and oil under "transient" conditions, and the resultant heating curves (Ref. 13) for these three items. Readers are also referred to another paper (Ref. 12) in which the temperature of the windings, as determined by short time tests, is discussed.

In conclusion, it should be noted that, by way of illustration, Figs. 1 and 2 have been drawn from laboratory tests on a 10 kVA air-cooled transformer with class 'B' insulation for which the guaranteed maximum temperature rise according to B.S. 171-1936 is 75° C. The use of short time tests is, of course, more important in the case of larger transformers in which case the saving in electrical energy would be correspondingly greater.

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NORTHERN IRELAND REPORT

THE problem of the economics of rural electrification is again raised in the Twentieth Annual Report of the Electricity Board for Northern Ireland. It is pointed out that shortage of materials and the rearmament programme had caused the schemes already in hand to fall behind schedule. Financial stringency was also pressing against future schemes. In these circumstances it was necessary to substantially revise the construction programme.

New Plant

In January, 1951, the fourth turbo-alternator was commissioned at Ballylumford, bringing the capacity of that station up to 124·5 MW. Outstanding work on the 110 kV line from Ballymena to Drumnakelly was completed early in the year, and the first three 110 kV small oil volume circuit breakers at Drumnakelly on which erection work was continued in the early part of the year went into service in April, 1951. The complete line switchgear and protective equipment were commissioned on May 1.

The Drumnakelly-Omagh line was completed in November, and work continued on switchgear and ancillary equipment. It was anticipated that the line would go into service in July, 1952.

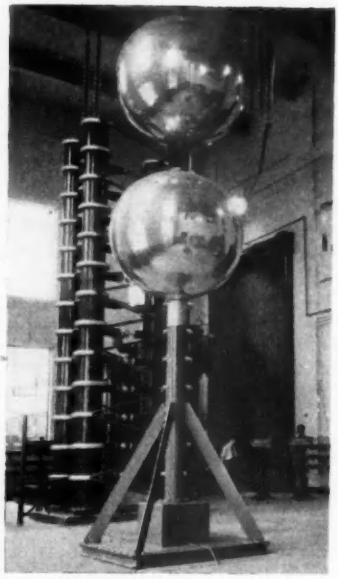
Approximately 348 miles of e.h.t. lines were constructed during the year, comprising 68 miles at 33 kV, 277 miles at 11 kV and 3 miles at 6·6 kV. The Board's system now comprises 210 miles of 110 kV, 1,175 miles of 33 kV 1,012 miles of 11 kV and 100 miles of 6·6 kV.

Finance

In order to repay short-term temporary loans, the Board issued at par £2 million 3½% stock. Further the borrowing powers were extended to an upper limit of £20 million. At the end of the year, the Board had borrowed up to £13,337,000.

Total gross revenue income amounted to £1,944,449 compared with £1,668,583 in 1950. After full provision for costs, interest and sinking fund, income tax and profits tax, a surplus on the year of £1,819 was shown. This has been added to the existing credit balance of £5,941 to give a total credit balance to be carried forward of £7,760.

BRUSH build new High Voltage LABORATORY



IMPULSE testing has become a common requirement for many types of h.v. equipment in recent years. To facilitate its application to their wide range of transformers, the Brush Electrical Engineering Co. of Loughborough has built an h.v. test laboratory with a 1,500 kV impulse generator as its centre piece. Last week this new building was formally opened by Sir Ben Lockspeiser, Secretary of the D.S.I.R.

The ample clearance so necessary in an h.v. laboratory is readily available in this 80 ft x 40 ft x 40 ft high building, which is an extension to an existing transformer shop. A rail track runs into one end of the laboratory to facilitate the transport of transformers to their test positions. Access is obtained through two large roller doors, which are interlocked with the test equipment as a safety precaution.

Total stored energy of the generator at peak voltage is 22·5 kW/sec. It is a 12-stage machine, each stage comprising two 0·12μF capacitors connected in parallel, with an effective output capacitance of 0·2μF. These capacitors have been supplied by T.C.C. Ltd. The charging current is obtained from a step-up transformer which feeds into a Westalite rectifier at 64 kV. The output from the rectifier is taken to a Cockroft-Walton voltage doubler circuit, and this in turn charges each of the stages to 125 kV.

To permit testing at various voltages, the generator is arranged for a variety of series-parallel connections. Some further variation of voltage is possible by adjustment of the tripping gaps. These are mechanically coupled, and driven by a small geared motor, via eccentric cams. Remote control of this feature is provided at the main control board, and the settings are indicated at this position.

For tripping purposes a Miller needle gap is used, an h.f. oscillation initiating break down of a pilot gap in the control gear. A variable switched time delay is provided in the pulse circuit, and this readily permits the selection of time delays between 0·5 and 25 micro-seconds. Thus there is an ample range available to ensure the recording of the desired portion of the voltage wave by the oscillographs.

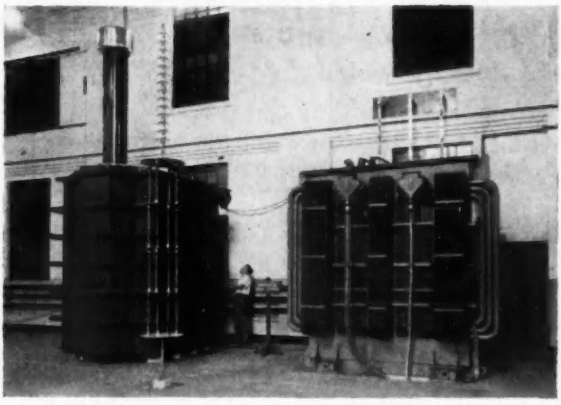
Measuring Facilities

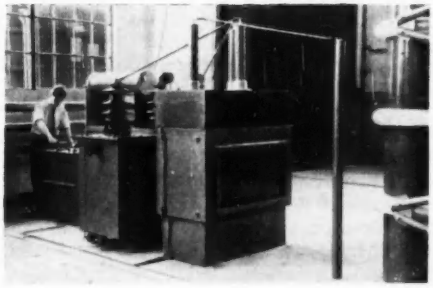
For voltage recording purposes, a matched resistance-capacitance voltage divider is used, the low voltage arm of which is wired back to the main impulse generator control board. Ultimate standard of voltage comparison is a 150 cm. sphere gap which has polished aluminium electrodes. The insulated sphere in this assembly is supported from the roof girders by three rod insulators, while the earthed component is movable, and driven by a geared motor unit through a range of 90 cm. Once again the setting at any time is indicated at the main control board. Two indicators are used, one covering 0-120 cm, and the other having a 10 cm range continuously repeated.

Recording of surges is performed by a bank of four high-speed 10 kV oscillographs, which are based on a circuit developed at the N.P.L. Sweep speeds of 0·5 to 250 micro-seconds are recorded on 35 mm film, using a camera with an f1·5 lens. Oscillographs and photographic equipment have been supplied by Southern Instruments Ltd. Together with remote control gear, they are mounted as a neat rack in a ground floor control room.

Power Frequency Equipment

For power frequency high voltage tests, current is obtained from a 2 MVA, 3·3/500 kV double wound transformer, which in turn is fed by a 2 MVA test alternator housed outside the laboratory. The h.v. winding of the trans-





Left: The 1·5 MV impulse generator and 150 cm sphere gap units tower above other apparatus
Above: 500 kV 250 kVA flashtesting transformer and 100 kV 5,500 kVA multi-ratio test supply transformer are used for power frequency work
Below: The charging transformer, doubling unit and polarity changing and earthing switch

former is arranged to facilitate future extension to 1,000 kV. This transformer was built by Brush, the special h.v. bushing necessary being supplied by Micanite and Insulators, Ltd.

For power factor and capacitance measurements, a Schering bridge (Cambridge Instruments) is installed. The standard capacitor used in conjunction with the bridge is a compressed gas design for 150 kV working, 100 pF, at 50 c/s. It uses nitrogen gas and is of a very compact design by Messrs. Micafil of Zurich.

All the high voltage equipment in the laboratory is interconnected by $1\frac{1}{4}$ in. diameter aluminium busbars. These are suspended from the roof members by strings of glass insulators, which are controlled by small hand winches to facilitate raising and lowering for reconnection. Master "make alive" and "make dead" buttons are provided on each section of the main control panel, and there are additional "make dead "controls on the observation gallery which is provided at one end of the laboratory.

Opening Ceremony

Sir Ben Lockspeiser was introduced at the opening ceremony by Mr. H. E. Midgely, a director of the Brush Electrical Engineering Co., who drew attention to his many services to science. In his speech, Sir Ben characterised the building and equipping of the laboratory as evidence of the company's determination to keep abreast of scientific advance. It was most important for this country to ensure that sufficient of the advances in electrical engineering that would take place by the end of the century were made in Britain, and they would originate in laboratories such as that which he was opening.

Electrical power was the key to industrial power, and in all manufacturing countries more and more attention was being paid to effecting economies in its generation and transmission, and to reducing avoidable waste caused by breakdown. Such objectives were the immediate concern of industrial laboratories.

Voltages were everywhere on the increase, a fact which caused attention to be focused on problems of insulation. As a result, h.v. tests were essential on all important items of plant. He hoped, however, that the laboratory would not confine itself to tests. Already the study of problems of insulation strength had led to valuable developments in other branches of physical science, and he thought it was of first importance that a due proportion of effort be devoted to fundamental enquiry to maintain the scientific capital of the subject. This provided, by the accumulation of knowledge, not only the surest basis known for the solution of problems in the future, but also the intellectual climate which promoted discovery and the growth of new ideas.

For the formal "opening," Sir Ben pressed a button as a signal for the discharging of the impulse generator. A demonstration of h.v. effects followed, after which the equipment was thrown open for inspection. It is understood that the laboratory has a two-fold purpose; the testing of completed transformers, both as a part of investigation and as acceptance tests, and the investigation of insulating materials and assemblies.

Our readers' views ...

Aluminium-Copper Fittings

THE reference in your Editorial headed, 'Warning on Aluminium,' is extremely interesting to us, as we have for years realised the danger of electrolytic corrosion when bi-metal contacts are exposed to the atmosphere. All our overhead line fittings, where dissimilar metals are used, have suitable insulation provided to keep the external surfaces of unlike metals apart.

As far as we are aware, fittings incorporating insulating washers have given entirely satisfactory service over long periods, but as you have raised the subject we feel that it would be of general interest to overhead line engineers if any of your readers who may have had trouble with these would care to report details.

G. Plant

PIRELLI GENERAL CABLE WORKS, SOUTHAMPTON

◆ ◆ ◆

Static on Cars

MR. E. R. ROBBINS' comments on static electricity in cars (Electrical Times of July 31) may well be justified, but in the circumstances in which I received a comparatively severe shock, posterior friction could not have been a contributary cause. I had hailed the taxi, and received the shock from the door handle when opening the door. My footwear was leather soled—not rubber—and the shock was therefore caused either by a charging current or a discharge to earth.

As far as the private car was concerned, the owner complained that commissionaires were becoming chary of opening the door for him, due to the shocks they received.

I understand, with regard to Mr. Robbins' experience with static generated by the flow of petrol through a flexible hose, that some time ago an article appeared in an American journal attributing crank case explosions in aircraft to sparks produced by static electricity. This was assumed in the article to have been built up by friction between oil and the moving parts of the engine.

LONDON, W.C.1 *E. Bartlett*

◆ ◆ ◆

MR. BARTLETT'S letter in your issue on July 17th, makes me wonder whether the shocks he experienced from a taxi-cab and a private car, were really due to static electricity in the cars. When getting out of my car while wearing rubber soled shoes in dry weather, I receive a shock when I touch the car. I have even seen a spark jump off the end of the key of my garage just prior to inserting it in the lock. I at first suspected ignition trouble but have now proved that the shocks are due to friction between the seat of my trousers and the seat of the car !

Stanley M. Harris

LONDON, W.1

CONSULTATIVE COUNCIL ESTABLISHED FOR HEAVY ELECTRICAL PLANT

JUST before Parliament adjourned for the summer recess the Minister of Supply, Mr. Duncan Sandys, announced the formation of a Heavy Electrical Plant Consultative Council. It replaces the Heavy Electrical Plant Committee whose meetings were discontinued in July, 1950.

Terms of reference for the new Council will be "to provide a means of regular consultation between the Government and the Heavy Electrical Plant industry on matters affecting the well-being of the industry and its contribution to the national economy". Meetings will be held under the chairmanship of the Minister of Supply.

In all, the Council will comprise seventeen members, who will include six electrical plant manufacturers, six water tube boiler manufacturers, three members of the B.E.A. and two representatives of the Confederation of Shipbuilding and Engineering Unions. Manufacturers will be represented by Sir Claude Gibb, Sir George Nelson, Sir Harry Railing, Mr. E. H. Ball, Mr. I. R. Cox and Mr. B. H. Leeson. Those giving the views of water tube boiler manufacturers will be Messrs. C. K. F. Hague, F. G. Mitchell, F. G. Penny, E. W. Thompson, W. E. Young and K. J. McKillop. Representatives of the B.E.A. will be Sir John Hacking, Sir Henry Self and Mr. I. A. Park. Union officials on the Council will be Mr. E. Foulkes and Mr. E. J. Hill.

The North of Scotland Hydro-Electric Board and Government Departments will be represented at meetings whenever appropriate.

ALUMINIUM *for distribution*

New methods of use are developed in America under pressure of acute copper shortage

COPPER has been short in the United States in the past few years, and this scarcity has coincided with a period of rapid expansion of electricity supply systems. In their efforts to keep close to constructional time schedules, the power companies have been forced to apply aluminium to conductor tasks usually reserved for copper, and in so doing they have accumulated experience which has some value for British engineers faced with related problems.

American ideas on the subject have been usefully summarised recently in our contemporary *Electrical World*, and special attention has been given to the difficulties that have accompanied the application of aluminium cables to distribution systems. As in this country, the suitability of s.c.a. conductors for transmission lines is well established, but for this application the special problems of joint design and of electrolytic corrosion at aluminium-copper junctions are far less pressing.

Basic Difficulties

What the difficulties are is explained in an article by Mr. M. D. Bergan. He places first the oxide film which forms on aluminium, and which is electrically a non-conductor. In stranded cables, this complicates connector design if efficient current sharing is to be obtained. Then there is the different thermal expansion characteristic of aluminium as compared with copper. The lighter metal has a coefficient some 38% greater, a fact which makes the use of aluminium connectors for mechanical Al-Cu joints necessary from thermal cycling considerations.

Since aluminium is a soft metal, it is necessary to spread the mechanical pressures associated with connectors over a fair length of cable, if damage is to be avoided. This is an important limiting factor in connector design, but the greatest is probably that associated with the electro-chemical relationship between aluminium and copper. The light metal is electropositive to its companion conductor, and so in the presence of moisture rendered conducting by, for instance, salt in solution, a joint between the two metals acts as a short circuited primary cell. The resultant electrolytic action corrodes away the aluminium end of the couple, to the disadvantage of joint efficiency.

One solution to this difficulty is tinning, since this metal is electrochemically intermediate between the other two. A practical way of connecting aluminium and copper conductors is to place both in an aluminium tube, separating the copper conductor from it by a heavily tinned copper sleeve.

Operating Experience

One company's experience of the problem has been given by Mr. J. P. Hayward, an official of a system operating on the coast of New Jersey. Encouraging experience had been obtained on this system with a large aluminium cable which operated from 1902 to 1951 without trouble, although connections and taps consisted of copper tightly wrapped on the aluminium. Over a period of about sixteen years, during which aluminium conductors have been used for many overhead distribution purposes, experiences have generally been satisfactory. An exception is where the bimetal connections are located within the spray range of salt water.

Electrical connections to such lines were formerly made with bronze split-bolt connectors with bimetal washers. When they were within the spray range several failures occurred within a year of erection. On the other hand, cases of trouble-free service in similar conditions existed. The present trend is towards using compression-type connectors.

Two cable company engineers, Messrs. L. F. Hickernell and L. L. Carter, have suggested that the limitations of aluminium should be kept well in mind and a selective priority list of applications should be established when aluminium has to replace copper in order to conserve the latter metal. In the U.S., overhead distribution must figure in this list at a high level if substantial tonnages of aluminium are to be saved, but experience is still lacking in this field.

A particular problem is the service drop to the consumer's premises, which in some cases is reported to comprise up to 40% of the metal purchased for o.h. distribution. Two main difficulties are facing companies here. The first is securing adequate strength for the conductor, while at the same time retaining economic

advantages. The authors suggest that the conservative approach is to use an a.c.s. neutral as the mechanical support, and to wrap or spiral round this the insulated aluminium phase conductor.

The connector problem, discussed above, is merely noted by the authors as a subject on which there is a wide range of contradictory evidence, and a wide range of practice.

Current Practice

In response to a widely circulated questionnaire, the *Electrical World* received replies indicating that lack of mechanical strength was the main reason advanced by companies not using all-aluminium conductors for distribution primaries and secondaries. In the majority of cases, however, such conductors were in use. Concerning aluminium-copper joints, the difference in practice mentioned by the authors quoted was apparent. For distribution secondaries, 37 instances of split-bolt type connectors were reported, 18 cases of parallel groove type, 13 of two-bolt clamps, and five of compression sleeves. Most companies applied an oxidation inhibitor to all such joints, and then covered the joints with friction tape. Although about half of those reporting the use of all-aluminium conductors appraised experience as "satisfactory," most indicated that it was as yet too early to give a final judgment.

Finally, in this survey of reported American practice in the use of aluminium, mention may well be made of a case where delay in delivery was avoided by the acceptance of aluminium conductors for a 15 kV underground cable. The cables as ordered were to have 500 m circular mils conductors, and in this design were some 12·5% lighter than the nearest standard size of copper cable of the equivalent carrying capacity. Sheath structure was the same in the two cases. Advantage was taken of the lighter construction, to work with a greater maximum pulling length.

Connectors between cable lengths are of the compression type, as attempts to develop a satisfactory welding or soldering technique did not meet with success. Where the cables join copper cables, a special connector, half copper, half aluminium, and electro-tinned, is used.

BRITISH STANDARDS

Sizes of X-ray Film and Intensifying Screens. *B.S.* 1443: 1952. *Price* 2*s.* This standard relates to X-ray film for medical and industrial use excepting those in dentistry and crystallography. Two additional prime nominal sizes have been added to the schedule of nominal sizes for these films, and where nominal sizes are in accord with those for photographic sheet film, as specified in B.S. 1772, the cutting dimensions and tolerances have been similarly adjusted.

Minimum requirements for Silvering for Glass Reflectors for lighting purposes. *B.S.* 1871 : 1952. *Price* 2*s.* Only minimum requirements for silvering are covered in this standard as no satisfactory methods are as yet available for testing reflectors as a whole. Two types of reflector are covered: (a) heavy duty for exterior use; and (b) general service reflectors to be used in normal atmospheric conditions, and requirements for glass blanks, edge sealing, and backing are also included. No provision has been made for processes relating to operating temperatures above 180° C.

Cooker Control Units Rated at 30 amps., 250 V Single-phase a.c. only. *B.S.* 1833: 1952. *Price* 2*s.* 6*d.* This standard lays down dimensional, performance and safety features of these control units and requires the inclusion of a shuttered socket-outlet complying with the requirements of B.S. 1363. It does not supersede or conflict with B.S. 438, "Cooker control units for use in two-wire circuits of not more than 250 V," which, with its permissible alternatives, has a wider field of application. The new standard is intended in the main to apply to domestic cooker control units of the type which would be used in estates of post-war houses where the electricity supply generally will be a.c.

Electroplated Coatings of Tin. *B.S.* 1872:1952. *Price* 2*s.* 6*d.* The present document deals with electroplated coatings of tin. It provides for coating of this metal on fabricated articles of iron, steel, copper and copper alloys, and covers five classes of coating according to the use to which the coating is to be put. It also provides details of samplings, finish, solderability, thickness, adhesion and heat treatment, together with the necessary methods of test.

Bi-pin Lamp-caps and Lamp-holders for Tubular Fluorescent Lamps. *B.S.* 1875:1952. *Price* 2*s.* 6*d.* As an adjunct to the recently published B.S. 1853, tubular fluorescent lamps (Class MCF/U), this standard covers two types of bi-pin lamp-cap, viz. G 13/23 and G 13/35, and the dimensions are in accordance with the recommendations of the International Electrotechnical Commission. It includes sections relating to general requirements, tests, marking and gauges, and includes an appendix on recommendations for fixing the lamp-holders.

British Standards reviewed above, are obtainable at the prices stated from the British Standards Institution, 24 Victoria Street, S.W.1.

Notes on Wiring
by MEGOHM

Cost Price Adjustment

Calculations for Electrical Installation Contracts

OVER past years contractors have had to maintain staff to deal with the preparation of account sheets showing the rise and fall in cost of materials and labour, submitting manufacturers' invoices, time sheets etc. and presenting summarised schedules showing the total costs involved. The preparation, presentation and agreement of these costs, which incidentally are only recoverable at net, has involved considerable time and money in reaching agreement with surveyors, especially on out of town jobs, when contractors' representatives have usually to deal with these matters on site with the surveyors.

Cost Formulae

With a view to simplifying the work involved in the preparation of variations in costs on materials and labour a formula devised by the British Electrical Allied Manufacturers Association with certain modifications has been applied by some authorities for the valuation of such costs, on electrical installation work and is applied as follows :—

For materials the contract price (C.P.) is multiplied by the percentage difference between the Index Figure (IF^1) published prior to the date of the tender and the Index Figure (IF^2) published at the 3/5 period of the contract and then multiplied by ·45 of the contract price per 1% variation. Expressed as a formula this becomes :—

$$\frac{CP \times (IF^2 - IF^1) \times 100}{IF^1} \times \frac{45}{10{,}000} = \text{Amount}$$

payable on materials.

As an example let us take the contract price to be £10,000, IF^1 at 250 and IF^2 at 300, then the return would equal £900.

The Board of Trade Intermediate Products Index Figures used in the formula are published monthly.

For labour variations the Contract price (C.P.) is multiplied by the difference in the labour rate (L^1) at the date of the tender and the labour rate (L^2) at the 3/5 period of the contract, expressed as a percentage of L^1 multiplied by ·4 of the contract price per 1% variation. This covers the 3/5 period of the contract and expressed in formula is as follows:—

$$\frac{CP \times (L^2 - L^1) \times 100}{L^1} \times \frac{4}{1{,}000} = \text{Amount payable for labour during 3/5 period of contract.}$$

As an example let us again take the C.P. at £10,000, L^1 at 40 pence and L^2 at 45 pence when the return would equal £500.

For labour increases arising any time after the 3/5 period of the contract separate calculations must be made for each rise. For instance if L^2 labour rate at the 3/5 period of the contract rose to another figure which we will call L^3 then the calculation would be based on:—

$$\frac{CP \times (L^3 - L^2) \times 100}{L^1} \times \frac{4}{1{,}000}$$

For example the C.P. is £10,000, L^1 40 pence, L^2 45 pence and say L^3 rises to 50 pence, then the return would equal £500.

The above sum of £500 must, however, be divided by the fraction of time still left to complete the work.

All subsequent labour increases must also be calculated separately in a similar manner and the sum of these values will be the total recoverable costs for labour.

The B.E.A.M.A. Contract Price Clause and Formula has been in use since 1940 and the factors ·45 of 1% and ·4 of 1% for materials and labour respectively have been arrived at after careful investigation on the basis that the sub-division of costs in manufacture in general show the material content to be ·45, the labour content ·4 and overheads ·15.

In connection with the average labour rate which should be established at the time of placing the tender, this is compiled from costs paid to adult operatives and on out of town jobs should include the costs for out allowances and fares.

Variations in the make-up and application of cost price, I am advised, are now being proposed such as: (1) the exclusion of items that form a substantial proportion of the contract price (2) the sub-division of the contract period into 6 monthly periods and (3) the adoption of the B.o.T. Index Figure for materials used in the Electrical Machinery Industry.

Contractors' engineers will no doubt give careful consideration to these proposals and maybe seek advice before acceptance.

The PER - UNIT *Method*

Its Application to Problems of Network Analysis Simplifies Calculations and Reduces Labour

By A. SALZMANN, Dipl. Ing., A.M.I.E.E.

THE application of the per-unit notation considerably simplifies network calculations, particularly when the voltage ratings of equipment associated with the network are dissimilar. This method reduces labour in analysing power networks, as impedances can be added regardless the system voltage. Decimal point errors are reduced since the multiplier factor "100" used to obtain per-cent. notation can be disregarded.

The per-unit value of circuit quantities such as ohms, volts, currents and volt-amperes is the ratio expressed as decimal of any quantity to an arbitrarily selected base. According to this definition the basic formulae for any circuit quantity is:—

$$\text{Per-unit value} = \frac{\text{Actual value}}{\text{Base value}} \quad \ldots\ (1)$$

Clearly only two arbitrary base values, usually MVA and kV, are required, while currents and impedances are obtained by calculation.

As an example let us find the per-unit quantities for a 5,000 kVA 33 to 11 kV 3-phase transformer with impedance voltage of 8%, assuming the base power is taken arbitrarily 5,000 kVA and line-to-line base voltage 11 kV. Then the base voltage on the h.v. side = selected base voltage times the tap ratio $= 11 \times \frac{33}{11} = 33\text{kV}$.

Calculated base quantities are: primary base current $= 5{,}000/\sqrt{3} \times 33 = 88\text{A}$ and secondary base current $= 5{,}000/(\sqrt{3} \times 11) = 262\text{A}$.

The base impedance referred to the h.v. side $= (33/\sqrt{3})\ 10^3/88 = 217$ ohms and the base impedance referred to the l.v. side $= (11/\sqrt{3})\ 10^3/262 = 24{\cdot}2$ ohms.

Actual circuit quantities are as follows: power = 5,000 kVA; voltage = 33/11 kV; currents = 88/262A, and impedance then becomes $\frac{0{\cdot}08 \times 33{,}000}{\sqrt{3} \times 88} / \frac{0{\cdot}08 \times 11{,}000}{\sqrt{3} \times 262} = 17{\cdot}4/1{\cdot}94$ ohms.

Per-unit values according to equation (1) then become current = 88/88 or 262/262 = 1·0 p.u. (small exciting current neglected); voltage: 33/33 or 11/11 = 1·0 p.u. (small reactance drop neglected); MVA: 5,000/5,000 = 1·0 p.u. and impedances = 17·4/217 or 1·94/24·2 = 0·08 p.u.

Formulae

Per-unit values can be obtained directly from equation (1). However, it is more convenient to determine these quantities by aid of formulae —particularly if the equipments associated with the network have different capacities and voltage ratings or the impedances of some network components are given in ohms or in percentage values.

Consider a transformer with an impedance voltage

$$Z\% = \frac{I \times Z(\text{ohms}) \times 100}{V} \quad \ldots\ (2)$$

where I = rated current; Z = line to neutral impedance expressed in ohms and V = line to neutral nominal or base voltage expressed in volts. By dividing equation (2) by "100" and substituting for $(Z\%/100) = z_u$, equation (2) can be written in the form

$$z_u = \frac{Z}{V/I} \quad \ldots\ (3)$$

In this equation V/I = (Base voltage/Base Current) represents the base impedance Z_b; Z the actual impedance.

Thus equation (3) satisfies the definition given in equation (1) and can be written in the form

$$z_u = \frac{Z\ (\text{Actual value})}{Z_b\ (\text{Base value})}\ \text{p.u.}$$

It is obvious, when comparing the per-unit method with the per-cent. method referred to the same MVA base, the factor "100" is eliminated. The numerical value of the per-centage impedance is equal to the per-unit value multiplied by "100."

The per-unit value expressed in terms of impedance (ohms), base MVA and base voltage can be obtained as follows.

Substituting in equation (3) for I = MVA $10^3/(\sqrt{3}\ V_L)$ where MVA = arbitrarily selected

mega-volt-amperes, and for $V = V_L 10^3/\sqrt{3}$ where V_L = line to line base voltage expressed in kilovolts we obtain

$$z_u = \frac{Z \times MVA \text{ per unit}}{V_L^2} \quad \ldots\ldots (4)$$

If the equipment, say a generator, has a per-unit value given by equation (4), assuming machine ratings (MVA and V_L) are used as bases, its per-unit impedance at bases MVA_1 and V_L is therefore according to equation (4)

$$z_{u1} = \frac{Z \times MVA_1}{V_L^2} \quad \ldots\ldots\ldots (5)$$

or combining equations (4) and (5)

$$z_u = z_u \times \frac{MVA_1}{MVA} \quad \ldots\ldots\ldots (6)$$

The per-unit impedance value of the generator referred to bases MVA and V_{L1} is:

$$z_{u2} = \frac{Z \times MVA}{V_{L1}^2} \quad \ldots\ldots\ldots (7)$$

or combining equations (4) and (7).

$$z_{u2} = z_u \frac{V_L^2}{V_{L1}^2} \quad \ldots\ldots\ldots\ldots (8)$$

In similar manner the per-unit value at bases MVA_1 and V_{L1} is

$$z_{u3} = \frac{Z \times MVA_1}{V_{L1}^2} \quad \ldots\ldots\ldots (9)$$

or combining equations (4) and (9) we obtain

$$z_{u3} = z_u \frac{MVA_1}{MVA} \times \frac{V_L^2}{V_{L1}^2} \quad \ldots\ldots (10)$$

Application

To show the method of application an example is given below. It is required to determine (*a*) The internal generating voltage and generator bus voltage in the circuit shown in Fig. 1. It is also necessary to maintain the load bus at 11 kV, if the system with various voltage ratings of equipment supplies a shunt load 10 MVA $\angle 36{\cdot}8^\circ$ (cos $\varphi = 0{\cdot}8$ lagging). (*b*) The currents in each section of the transmission system, assuming the operating tap on the step-up transformer is 12 to 36 kV and the step-down unit 11·5 to 33 kV. (*c*) In-phase and quadrature boost voltage, in order to secure equal load division between both feeders. It is here assumed that the generator bus is linked with the load bus through a tie line and transformer Ts is fitted with in-phase and quadrature taps. (Fig. 1, dotted line.)

Data for equipment and transmission lines are given in Table 1. The effects of capacitance and conductance are negligible, due to the short transmission line.

TABLE 1. SYSTEM CHARACTERISTICS FOR THE EXAMPLE

Units	Rated MVA	Rated Voltage kV	Per-unit Impedance Values		Impedance Ohms
			Rated Base	50 MVA Base	
G	25·0	13·0	0·1	j 0·306	—
T_S	10·0	12/36	0·1	j 0·658	—
L_1	—	36	—	1·61/84·1°	3·28+j 8·0*
T_R	10·0	33/11·5	0·1	j 0·545	—
L^2	10·0	11·0	—	0·545/29·7°	1·12+j0·65†

* Length 15 miles 0·15 sq in. O.H.L.
† Length 5 miles 0·2 sq in. cable.

The selected power base is taken as 50 MVA and the line-to-line voltage as 11 kV (selected arbitrarily taking the load circuit as reference). Then the calculated base values are: Line-to-line voltage for the transmission line circuit $= 11 \times \frac{33}{11{\cdot}5} = 31{\cdot}4$ kV, and for the generator circuit $= 11 \times \frac{33 \times 12}{11{\cdot}5 \times 36} = 10{\cdot}5$ kV, and the base currents are: load circuit $= 50 \times 10^3 (\sqrt{3} \times 11)^{-1} = 2{,}620$A. Transmission line circuit: $50 \times 10^3 (\sqrt{3} \times 31{\cdot}4)^{-1} = 920$A. Generator circuit: $50 \times 10^3 (\sqrt{3} \times 10{\cdot}5)^{-1} = 2{,}760$A.

Per-unit Values

1. *Impedances:*

Generator: $j0{\cdot}1 \frac{50}{25} \times \frac{13^2}{10{\cdot}5^2} = j0{\cdot}306$ p.u. (from equation (10)).

Step-up transformer: $j\,0{\cdot}1 \frac{50}{10} \times \frac{36^2}{31{\cdot}4^2} = j\,0{\cdot}658$ p.u. (from equation (10)).

Transmission line: $15\,(0{\cdot}219 + j\,0{\cdot}535) \frac{50}{31{\cdot}4^2}$ $= 0{\cdot}166 + j\,0{\cdot}405$ p.u. (from equation (5)).

Step-down transformer: $j\,0{\cdot}1 \frac{50 \times 11{\cdot}5^2}{10 \quad 11^2}$ $= j\,0{\cdot}545$ p.u. (from equation (10)).

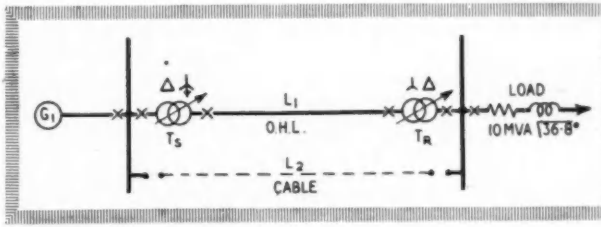


Fig. 1. Schematic single line diagram of a transmission power system

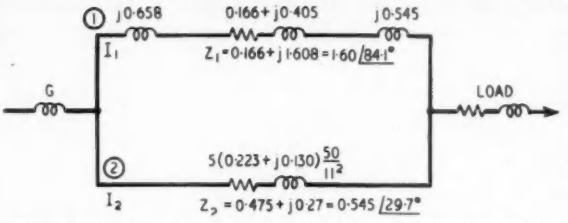


Fig. 2. Equivalent circuit for the transmission system shown in Fig. 1 with cable L_2 in circuit

Total impedance: $Z = j0{\cdot}306 + j0{\cdot}658 + 0{\cdot}166 + j0{\cdot}405 + j0{\cdot}545 = 0{\cdot}166 + j1{\cdot}914 = 1{\cdot}92\underline{/85^\circ}$ p.u.

Load impedance: load expressed in terms of impedance $= Z_L = \frac{(11/\sqrt{3})^2 10^3}{1/3 \times 10{,}000\underline{\backslash 36{\cdot}8^\circ}} = 9{\cdot}7 + j\,7{\cdot}25 = 12{\cdot}1\ \underline{/36{\cdot}8^\circ}$ ohms. The per-unit value $= (9{\cdot}7 + j\ 7{\cdot}25)\ \frac{50}{11^2} = 4{\cdot}0 + j\ 3{\cdot}0 = 5{\cdot}0\underline{/36{\cdot}8^\circ}$ p.u. (from equation (5)).

2. *Load:*

$$L = \frac{10\underline{\backslash 36{\cdot}8^\circ}}{50} = 0{\cdot}2\underline{\backslash 36{\cdot}8^\circ} \text{ p.u. (equation (1)).}$$

3. *Current:*

$$I = \frac{10 \times 10^3\ (\sqrt{3} \times 11)^{-1}\underline{\backslash 36{\cdot}8^\circ}}{50 \times 10^3\ (\sqrt{3} \times 11)^{-1}} = 0{\cdot}2\underline{\backslash 36{\cdot}8^\circ} \text{ p.u.}$$

Voltages

Per-unit internal generating voltage = E_G = (Voltage across the shunt load) + (Transmission circuit voltage drop).

$E_G = I_L\underline{\backslash 36{\cdot}8^\circ} \times Z_L\underline{/36{\cdot}8^\circ} + I_L\underline{\backslash 36{\cdot}8^\circ} \times Z\underline{/85^\circ}$
$= 0{\cdot}2\underline{\backslash 36{\cdot}8^\circ} \times 5\underline{/36{\cdot}8^\circ} + 0{\cdot}2\underline{\backslash 36{\cdot}8^\circ} \times 1{\cdot}92\underline{/85^\circ}$
$= 1{\cdot}253 + j\ 0{\cdot}286 = 1{\cdot}28\ \underline{/12{\cdot}9^\circ}$.

Actual internal generating voltage = E_G = $1{\cdot}28/12{\cdot}9^\circ \times 10{\cdot}5 = 13{\cdot}4$ kV.

$E_G = 1{\cdot}0\underline{/0^\circ} + 0{\cdot}2\underline{\backslash 36{\cdot}8^\circ} \times 1{\cdot}92\underline{/85^\circ} = 1.25 + j0{\cdot}286 = 1{\cdot}28\underline{/12{\cdot}9^\circ}$ p.u.

Per-unit generator bus voltage = $V_G = 1{\cdot}0\underline{/0^\circ} + 0{\cdot}2\underline{\backslash 36{\cdot}8^\circ} \times Z_T^1$, where Z_T^1 is the impedance between load and generator bus. $Z_T^1 = j0{\cdot}658 + 0{\cdot}166 + j0{\cdot}405 + j0{\cdot}545 = 0{\cdot}166 + j1{\cdot}608 = 1{\cdot}62\underline{/84{\cdot}1^\circ}$ p.u.

$V_G = 1{\cdot}0\underline{/0^\circ} + 0{\cdot}2\underline{\backslash 36{\cdot}8^\circ} \times 1{\cdot}62\underline{/84{\cdot}1^\circ} = 1{\cdot}22 + j0{\cdot}236 = 1{\cdot}24\underline{/11^\circ}$ p.u.

Actual generator bus voltage =
$V_G = 1{\cdot}24\underline{/11^\circ} \times 10{\cdot}5 = 12{\cdot}8$ kV (equation (1)).

Currents

As the current is given by per-unit value × base value (from equation (1)), we have for the load circuit, current $= 0{\cdot}2\underline{\backslash 36{\cdot}8^\circ} \times 2{,}620 = 525\underline{\backslash 36{\cdot}8^\circ}$ A; for the transmission circuit $= 0{\cdot}2\underline{\backslash 36{\cdot}8^\circ} \times 920 = 184\underline{\backslash 36{\cdot}8^\circ}$ A;

(Check: $525\frac{11{\cdot}5}{33} = 184$ A) and for the generator circuit $= 0{\cdot}2\underline{\backslash 36{\cdot}8^\circ} \times 2{,}760 =$
$552\underline{\backslash 36{\cdot}8^\circ}$ A. (Check: $525\ \frac{11{\cdot}5}{33} \times \frac{36}{12} = 552$ A.)

Load sharing between feeders with dissimilar characteristics can be controlled by introduction of a boost voltage e_b comprising in-phase and quadrature components. This voltage is injected in the feeder with the larger impedance.

To find the current distribution prior to the boost voltage application, we work out the impedance per-unit value as follows:

For feeder (1), $Z_1 = 0{\cdot}166 + j\,1{\cdot}608 = 1{\cdot}6/84{\cdot}1^\circ$.

Feeder (2), $Z_2 = 0{\cdot}475 + j\ 0{\cdot}27 = 0{\cdot}545/29{\cdot}1^\circ$.

The loop impedance $(Z_{12}) = Z_1 + Z_2 = 0{\cdot}641 + j\ 1{\cdot}878 = 1{\cdot}98/71{\cdot}2^\circ$.

The current per-unit values then become:

Feeder (1), $I_1 = I\frac{Z_2}{Z_{12}} = 0{\cdot}2\underline{\backslash 36{\cdot}8^\circ}\ \frac{0{\cdot}545/29{\cdot}7^\circ}{1{\cdot}98/71{\cdot}2^\circ}$
$= 0{\cdot}55\underline{\backslash 78{\cdot}3^\circ} = 0{\cdot}011 - j\ 0{\cdot}0536$ p.u.

Feeder (2), $I_2 = I\frac{Z}{Z_{12}} = 0{\cdot}2\underline{\backslash 36{\cdot}8^\circ}\ \frac{1{\cdot}6/84{\cdot}1^\circ}{1{\cdot}98/71{\cdot}2^\circ}$
$= 0{\cdot}162\underline{\backslash 23{\cdot}9^\circ} = 0{\cdot}148 - j\ 0{\cdot}0655$ p.u.

(Check: $I_1 + I_2 = I$ must be equal $0{\cdot}2\underline{\backslash 36{\cdot}8^\circ}$
$= 0{\cdot}16 - j\ 0{\cdot}12$ against $0{\cdot}1591 - j\ 0{\cdot}119$ p.u.)

If the currents in feeder (1) and (2) are to be made equal, $I_1 = I_2 = 0{\cdot}08 - j\ 0{\cdot}06$ p.u. the transfer of a current $I_c = I_2 - \frac{I}{2} = (0{\cdot}148$
$= j\ 0{\cdot}0655) - (0{\cdot}08 - j\ 0{\cdot}06) = 0{\cdot}068 - j\ 0{\cdot}0055$
$= 0{\cdot}0685\underline{\backslash 4{\cdot}7^\circ}$ from feeder (2) to (1) must take place. This is achieved by giving the boost voltage e_b a magnitude of $e_b = I_c \times Z_{12}$.

Thus the circulating current I_c increases the current in feeder (1) from I_1 to $(I_1 + I_c)$ and decreases the current in feeder (2) from $(I_2 - I_c)$

Boost voltage: $e_b = I_c Z_{12} = 0{\cdot}0685\underline{\backslash 4{\cdot}7^\circ} \times 1{\cdot}98\underline{/71{\cdot}2} = 0{\cdot}136/66{\cdot}5^\circ = 0{\cdot}054 + j\ 0{\cdot}1245$ p.u.

Thus equal load sharing between the feeders is secured by injecting in feeder (1) 5·4% in-phase and 12.4% quadrature boost voltages.

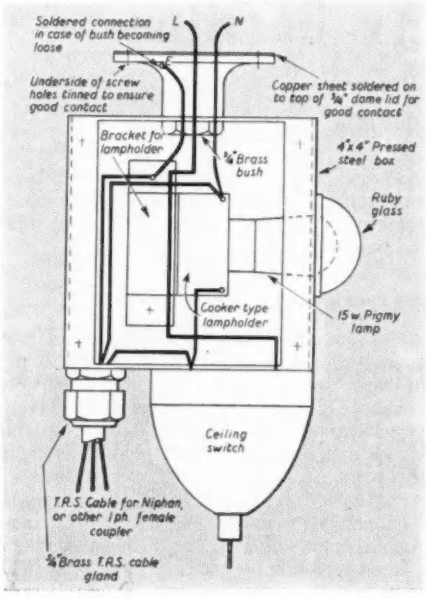
Problems and Practice

IN ENGINEERING

Coupling Unit for Portable Tool

WHILE it is common practice to supply portable appliances from a power plug point it sometimes happens that such an outlet is not available. In many cases the only alternative is to take a supply from a light point. This supply is usually obtained by plugging a lead with a light adaptor into the light fitting after withdrawing the lamp, frequently without regard to the efficient earthing of the tool.

This method of connection is very unsatisfactory, particularly in the case of a b.c. lampholder as (a) the plungers and springs are not meant to carry a large current, (b) if the earth wire of the cable is not secured to the conduit box, clipping or twisting it on to the conduit gives a doubtful earth connection, (c) the adaptor has no satisfactory cable grip and a sharp pull on the cable may pull the wires out of the adaptor.


Soldered connection in case of bush becoming loose
L
N
E
Underside of screw holes tinned to ensure good contact
Copper sheet soldered on to top of ⅛" dome lid for good contact
Bracket for lampholder
½" Brass bush
4"x4" Pressed steel box
Ruby glass
Cooker type lampholder
15 w. Pigmy lamp
Ceiling switch
T.R.S. Cable for Niphan, or other 1 ph. female coupler
½" Brass T.R.S. cable gland

Arrangement of coupling unit for supplying a portable tool from a lighting point when a wall socket is not available

Furthermore, the practice of plugging in to a light point with an adaptor in order to supply a portable tool has been ruled as unsatisfactory by a High Court decision.

Where the supply for a portable appliance can only be obtained from a lighting circuit installed in screwed conduit, the coupling unit shown has been developed. The drawing and wiring diagrams are self explanatory, the following points being kept in mind : (1) an efficient earth, (2) indication to show when the switch is "on" or "off," (3) easy and safe means of operating switch due to the height of the supply point.

To fix the unit, the light fitting is disconnected and taken down, and the ends of the coupling unit connected into the light point connectors.

The coupling unit should be kept in charge of an electrician who is the only person authorised to fit it up when a portable tool has to be supplied from a light point.

It is believed that this unit when fitted and maintained by an electrician, makes the supply from a light point as safe (subject to current loading), as that from a plug power point. —*Clartot.*

An Unusual Domestic Hazard

A NEWLY married couple had been presented with a pair of electrically heated blankets. On the approach of winter, the husband, a practical man, but with no particular knowledge of electricity connected both, *via* torpedo switches (so that each partner could adjust the heat individually) into the reading-lamp plug. That night both were switched in, and operated satisfactorily. In the small hours of the morning the husband reached over towards his wife with a grunt of endearment and was startled to find that she was electrically as well as physically, alive. After making sure that the blankets were switched off, he removed the plug from the socket, and spent the rest of the night on his own side of the bed.

The following morning the installation was tested and it was found that the insulation resistance was too high to account for this. Further tests with the husband, and area engineer, using a neon tester, established that with both blankets switched off, one occupant was live to the other, but this occurred with no other combination of switch positions.

It was found that the torpedo switches were single pole, and one was in the phase lead and the other in the neutral. It appeared that the stray capacitance between either spouse and resistance element of the blanket, and the body resistance would act as a potential divider. The trouble was cured by putting both switches in the phase lead.

This occurred in the Middle East. I wonder whether any of your readers has met with anything similar in the U.K.—*F. E. M. Hardy.*

Brass in Circuit

A RECENT problem presented concerned the operation of a circuit breaker controlled by a solenoid. Initially, by pressing a push-button, the solenoid is excited by the full line voltage, drawing up the plunger and closing the circuit. After contact is made, the button is released automatically connecting a high value resistor in series with the winding, allowing only sufficient current to hold the plunger in position. On testing the breaker, it was observed that on releasing the button the plunger would fall back after only a few seconds, consequently opening the circuit. Deciding to dismantle the equipment, suspecting a fault in the solenoid, the fault was discovered as soon as the plunger was removed. A brass washer had been placed at the end of the plunger, presumably to reduce the effect of residual magnetism. However, due to the washer being over an eighth of an inch thick, it was weakening the hold of the plunger to below the critical value for the reduced current in the solenoid. By using a brass washer only a sixteenth thick the plunger, on replacement, was seen to work satisfactorily.—*B.D.*

Electrical Safety in Mines

IN his report for the year 1950, which has just been published, H.M. Principal Electrical Inspector of Mines reviews a period during which five persons were killed in and about mines as a result of electrical accidents, and 67 seriously injured. In the middle of the period (June 30, 1950) there were 92,499 electric motors in use at mines, totalling 3,070,625 h.p. in rating; 55,299 of these machines operating underground, totalled 1,752,620 h.p.

Two fatal accidents were the result of electric shock. In one case an electrician was making alterations to an old design of switchboard in which oil-immersed switches were mounted behind slate panels. He apparently mistook a live for a dead switch, and in attempting to short-circuit its terminals, was electrocuted. The other incident concerned a coal-cutter machineman, who received a shock when the live unscreened cable supplying the machine was damaged by the moving cutter picks. It is considered that the use of a screened cable associated with leakage protection might have prevented the accident.

Two dangerous occurrences, which resulted in fires, occurred as a result of damage to flexible cables supplying coal cutters. In connection with these, the report stresses the advisability of keeping the flexible cable always in front of the machine at the haulage end.

In a general discussion of safety aspects, the report draws attention to the problem of automatic protection for small thrustors and solonoids for conveyor braking devices, and for the cables supplying them. The main motors concerned are usually of so high a horse-power that their protection is of little use for the auxiliary gear. A small automatic circuit-breaker electrically interlocked with the circuit-breaker for the main motor appears to offer the best solution.

Old Switchboards

Old-type switchboards, already mentioned in connection with a fatal accident, are still in use in considerable numbers. In 1950 there were at least 37 open-type boards and 65 with switchgear mounted behind slate or marble panels and operated by rods and levers from the front of the board. In the absence of modern safeguards, no inspection or repair work can be carried out unless the whole board is shut down. Because complete shut-down is seldom possible, inspections are few. The remedy lies in replacement of the boards, which often have switches of inadequate breaking capacity, by modern standards.

Amongst other matters discussed in the report is the gradual replacement of unscreened by screened trailing cables. Although the total number of flexible cables increased from 10,752 to 15,664 between 1943 and 1950, and of pliable wire-armoured cables from 2,572 to 9,253, the number of unscreened cables in the former category decreased from 4,121 to 230.

A 1,000 kW Gas-turbo Alternator

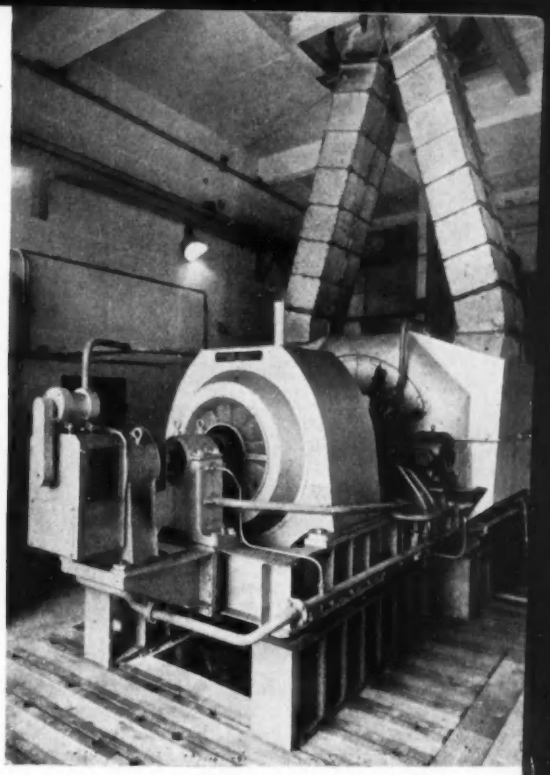
Admiralty Unit completes running tests

SOME time ago, in our issue of November 15, 1951, we gave details of the 1,000 kW gas-turbine alternator built by W. H. Allen and Co. of Bedford for Admiralty use. This machine has now undergone extensive testing, and last week we were privileged to see a demonstration of the machine operating under various conditions of load.

Construction Type

Some brief recapitulation of the salient design points of the machines is included for the sake of completeness. The design adopted is comparatively straightforward, consisting of an axial flow compressor with a compression ratio of 4½: 1 driven by a two-stage turbine, a one-stage power turbine driving the alternator through epicyclic gearing, and a heat exchanger. Due to the Admiralty specification of dimensions the heat exchanger has been built round a driving shaft from the power turbine to the gearbox and thus has had to be made small and compact. The overall height of the set is some 7 ft with a length of 16 ft and a breadth of 8 ft 6in. Total weight of the turbine and heat exchanger is about 8½ tons.

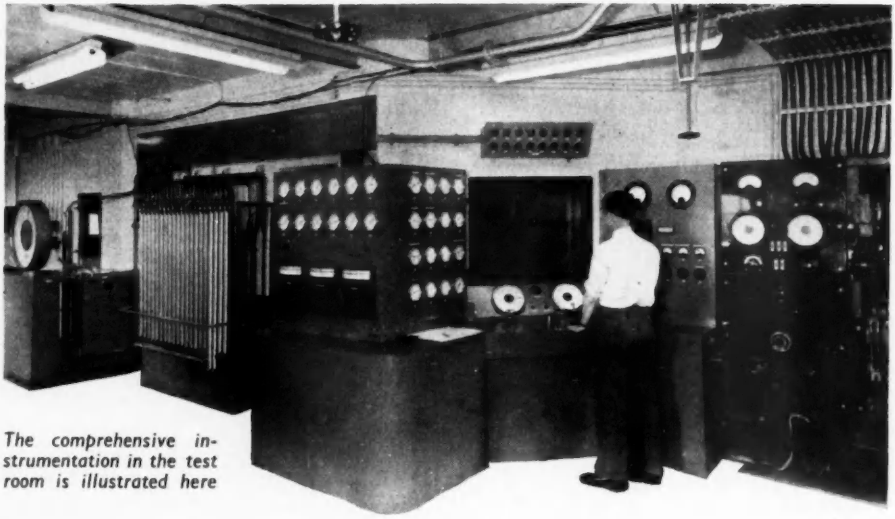
The Admiralty specification called for a set of 1,000 kW, m.c.r., with a 20% overload for 10 mins; to be suitable for operation at all loads up to overload under temperate (60° F) or tropical conditions and capable of running in parallel with other steam turbo-alternators. Governing requirements were 2½% speed change for 50% load change and the ability to accept or shed 100% load without operation of the emergency gear. Fuel was to be Diesel oil, and a maximum consumption of 1·27 lb/kWhr was called for. A life of 100,000 hr was to be aimed at, this being made up of 65,000 hr at 80% power under temperate conditions, 33,000 hr at 80% power under tropical conditions and 2,000 hr at full power under tropical conditions.



Above is a view of the gas turbine looking at the generator end

At the time of writing our previous article, the set had been run for some time under test conditions, but the heat exchanger had not been included. Now further work has been done including the heat-exchanger. Several minor troubles have been eliminated and various modifications introduced during the intervening period, though it should be emphasised that the turbine itself has been trouble-free. One of the initial difficulties was that of ensuring good ignition. The use of high tension ignition led to difficulties in maintaining good insulation values in the leads due to the high temperatures of the casing. This has been cured by using a low tension system. A further burner trouble was that after shutdown residual oil on the burners carbonised, resulting in clogging of the jets. A method of overcoming this was by motoring the compressor, thus providing cooling air over the burner system. It is, however, proposed to use a spill burner system on future sets, which should eliminate such troubles.

The set has come well up to the design characteristics although the overall performance is a little below that estimated mainly due to an air leak in the heat exchanger which reduced its effectiveness. This leak was caused by the difficult annular shape of the exchanger which was dictated by the design space limitation and



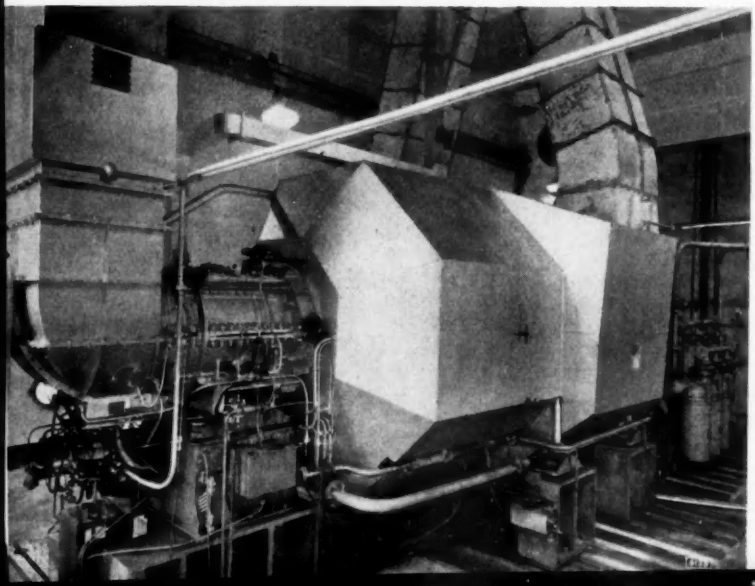
The comprehensive instrumentation in the test room is illustrated here

will be rectified before further running of the set. Both compressor and turbine efficiencies have, however, been independently verified by test rig running, and have been confirmed by the tests on the complete unit.

Governing

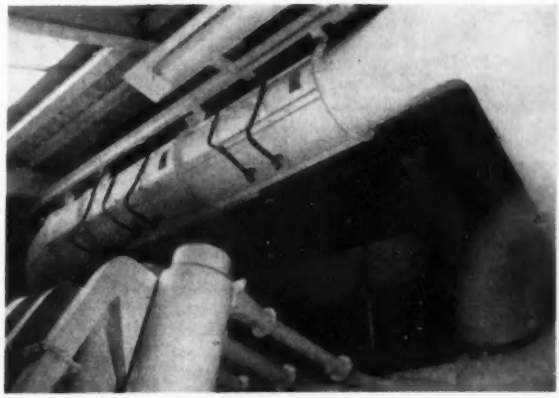
Governing of a two-shaft machine of this nature presents many difficulties. A 500-lb flywheel on the power turbine shaft serves to hold the speed to a certain extent during sudden load changes, while the compressor inertia has been reduced as far as possible to enable it to accelerate or decelerate rapidly. In addition, pass off valves have been fitted to the turbine inlets to bypass combustion and secondary air to exhaust if the load is thrown off suddenly. This avoids speeding up of power turbine. With a sudden increase of load from 0 to 25%, the speed change is —2·5%. From 50 to 75% it drops to —2·4% and from 75 to 100%, to —2·2%. Reducing load suddenly from 100-75% results in a speed change of +1·55%; from 75-50% the figure is +2·1% and from 50-25% the change is +2·3%. The machine, under sudden load changes, settles down remarkably quickly to the new working conditions.

Opportunity was also taken while we were at the Works, to examine a small 200-h.p. machine. In this case, as high efficiency is not required, a centrifugal compressor on the main shaft has been provided, the other side of the compressor disc being a radial flow turbine. One combustion chamber only of the contra-flow type will be used. As this machine is effectually a prototype model, no performance details were found to be available.



Here is a view on the compressor end of the set. The heat exchanger is in the background

A use of contra-rotating axial flow fans in milling



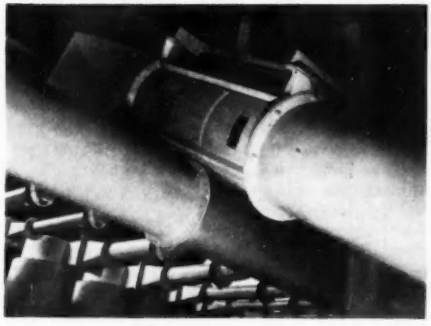
CONVEYING FLOUR

THE pneumatic conveying of flour requires fairly high pressures, and in the past centrifugal fans have always been used for this purpose. The introduction of the high pressure contra-rotating Aerofoil fan by Woods of Colchester, however, led to experiments being carried out by Henry Simon, Ltd., at the experimental mill at Cheadle Heath, Stockport. These experiments culminated in the installation of axial fans at the Hovis Mill, Westminster.

This mill, handling 132 tons of flour per day, has a pneumatic conveying system incorporating 75 lifts and divided into three separate sections. Each section has now been powered with a Woods five-stage Aerofoil unit.

It may be remembered that each Woods fan has two contra-rotating impellers which are driven by independent motors. As thereby the air is only rotating between the two impellers losses are minimised and the pressure increased. A standard fan will give a static pressure of 7 in. w.g. with a tip speed of only 14,000 ft per min. A further point is that units can be connected end to end to give multi-stage fan, the pressure being directly proportional to the number of units so connected. Control can also be simply exercised by switching off one motor and allowing the impeller to idle. With a four or five stage unit this method permits a wide range of control.

The upper photo shows an Aerofoil five-stage contra-rotator fan in the pneumatic conveying system at the Westminster Mill of Hovis Ltd. To save space one five-stage unit was divided, three stages being on the other side of the 90° bend seen extreme left of the lower photo



Experience at Hovis Ltd.

At the Westminster Mill, the fans are included directly in the pipe lines, and, as can be seen from the photographs, are scarcely to be differentiated from the pipes. In two of the three systems, all five units are bolted together; in the third for convenience, two stages have been placed before a right-angled bend, the third being after the change in direction. With each fan, the fifth stage is used for boosting at starting up and is subsequently switched off. Together, the three units consume some 38 h.p. against the centrifugal fan figure of about 59 h.p., a saving of some 35% in power consumption.

A particular point is the fact that the fans can be installed in confined spaces, avoiding the pipe bending necessary with the centrifugal type and leading to a cleaning up of the layout. Special requirements of flour milling are met by the introduction of Buxton-tested flame-proof squirrel-cage motors, and the provision of a fine surface finish to the fan blades. This latter requirement is met inherently by the Aerofoil impeller which is diecast from silicon-aluminium alloy in polished steel moulds.

Noise from the fans is particularly low and they can scarcely he heard above the general background sound level of the mill.

overseas news

Record Connections

During the year ended June 30 last, the State Electricity Commission of Victoria connected 27,000 new consumers—an all-time record, the chairman, Mr. R. A. Hunt, announced recently. The previous highest year's total was 24,677, for the 1950-51 financial year. The commission now serves a total of 442,682 domestic, commercial and industrial consumers. Mr. Hunt added that 75% of the new connections were in the country, and approximately 2,300 farms were given supplies.

N.S.W. Unhappy

The New South Wales state's reduced loan allocation this financial year would not permit it to spend money on two 70,000 kW power stations which would be needed in about two years, the Premier, Mr. J. J. Cahill, has declared. He said the Prime Minister, Mr. Menzies, had been asked to arrange for the purchase of the two 70,000 kW stations while in America, but he did not make the arrangement. As a result New South Wales would face a shortage of electricity in another two years the same as today. The state had been told that they could buy dollars from the Commonwealth out of the Australian loan to purchase in America. But this year's loan allocation was barely enough to pay for generating plant already being installed in N.S.W., Mr. Cahill added.

Clarence River's Loss

Despite increased revenue—£527,436 as against £442,635 for the previous year—the electricity undertaking of the Clarence River County Council, New South Wales, made a nett loss of £53,652 for the year ended December 31 last, it is shown in the annual report, just received. The chief reason —not an unusual one—was that the cost of fuel oil and of other supplies had climbed, along with increases in wages, etc., and the loss resulted despite successive rises of 25% and 16% in tariffs during the year. Another trouble was that output of the Nymboida hydro-electric station was reduced by 13% due to shortage of water, and increased load-shedding became necessary. To alleviate the position pending the commissioning of the Koolkhan steam power station, probably later this year, a 1,000 kW U.S. diesel generator has been obtained, and plans are being prepared to develop the Upper Nymboida, with an initial output of 6,000 kW from the Cloud's Creek scheme. The undertaking, a thriving one, serves a number of country districts along a coastal strip of New South Wales, and at the end of 1951 supplied 16,452 consumers in addition to giving bulk supplies to other authorities. The Sales Department, too, made a profit of £34,835, due to improved supplies of appliances.

Restrictions Eased

There has been a slight lifting of power restrictions in Victoria. The State Electricity Commission has announced that industrial and commercial consumption quotas have been ended together with restrictions on shop window and display lighting. Household consumption quotas have been abolished, and radiators and immersion heaters may now be used except between 7.30 a.m. and noon, and 5 p.m. to 7 p.m., Mondays to Fridays. Mr. R. A. Hunt, chairman of the Commission, has stated that the factors which had enabled the restrictions to be eased were a promised early increase in generating capacity, a sufficiency of fuel for metropolitan and provincial power stations for the first time since 1945, and an increase in hydro-electric output.

Output Increases

The monthly output of power stations in Canada continues to steadily increase. The figure for May, for instance, at 5,334·9 million units, beat the previous monthly record total of 5,268·7 millions, for January last, and was 4% above last year's May output of 5,131·9 million units, according to a report issued by the Dominion Bureau of Statistics. With gains being recorded over a year earlier in each month from January to May, the cumulative total for the first five months of this year advanced to 25,821·6 million units from 24,105·6 million units in the similar period of 1951, or by seven per cent. Consumption of primary power—production, less net exports and secondary power—increased to 4,595·8 million units from 4,409 million units in May last year, and in the five months advanced to 23,057·4 million units from 21,389·2 million units.

Lake Ontario Doubts

When the International Joint Commission opened its public hearings on the Canadian-U.S. application for permission to develop the power potential of the St. Lawrence River, a few days ago, the main point of argument was the high level of Lake Ontario, and every witness seemed to take it for granted that the Commission would ultimately approve the project. Those who gave evidence pleaded for a guarantee that some method of dropping and controlling the high water would be included in the scheme. One witness expressed the fear that the scheme would operate under conditions that would keep Lake Ontario always at a maximum level of 249 ft, which would bring

destruction along the lake shore. He and others suggested an ideal controlled level of 245-246 ft. In this hearing before the Commission all parties objecting to the project are entitled to be heard, and interest locally is centred on whether any attempt will be made by opponents to excessively extend the sittings.

Power for Whole Gaspe Area

Quebec Hydro-Electric Commission has officially announced a $100m. project to supply the whole of the Gaspe Peninsula.

30 miles west of Baie Comeau, a pulp and paper centre, the Bersinims River joins the St. Lawrence. It is here that the project will be sited.

M. Duplessis, Premier of Quebec, in the announcement referred to future mining developments in the area, adding that industrial expansion would be "colossal".

Using Methane

Following on the recent inauguration of the Tavazzano thermo-electric centre, in Italy, which operates on natural methane gas (described in our July 24 issue), there are indications that the use of methane in industry is rapidly increasing. It is now reported that the FIAT organisation is making preparations to run all its plants on the natural gas and to dispense completely with the use of coal. It is estimated that the plants will consume 500,000 cu. metres of methane daily instead of 750 tons of coal. The conversion is made possible by the recent completion of a new pipeline, with a daily capacity of 3½ million cu. metres of gas, from Cortemaggiore to Turin—a distance of 210 km.

Progress in Cyprus

Our latest news from Cyprus is that the island's electrification scheme is rapidly nearing completion. The first two generating sets have been installed at the Dekhelia power station near Larnaco, on the south coast, but the Working Committee for the scheme anticipate that the station will not go on commercial load till September, as certain types of switchgear have still to be completed. Reports from the manufacturers indicate that the switchgear, transformers, cables, etc., for the distribution scheme in Nicosia, Limassol and Famagusta will be delivered and installed within the next two months. The main 66 kV overhead transmission line from Dekhelia to Famagusta has been completed and the stringing of conductors along the route of the 66 kV lines from Dekhelia to Nicosia and Limassol is well in hand. As many parts of Cyprus will shortly be getting a supply of electricity for the first time, there is much discussion locally on tariffs and wiring installations. The Working Committee has pointed out that decisions on tariffs and trading policy must be left to the future Authority which will be established by law. And consumers' installations must conform with the Regulations made under the Electricity Law (cap. 82), and by which authorised undertakings must be guided.

Pakistan's Move

A change in the control of two Pakistan electricity concerns, both of which were previously controlled by firms in India, is reported. The first is the Dacca Electric Supply Co., Ltd., managing agents of which are Octavius Steel and Co., Ltd., of Calcutta. It is stated that the Pakistan government proposed to reorganise and run the Dacca undertaking under a new name with the government controlling 51% of its share capital. The second concern, the Electric Supply and Engineering works of Chittagong, owned by Messrs. K. K. Sen, have been informed by the Pakistan Government that their licence has been terminated as from the end of July. This move is the outcome of a policy decision taken recently by the Pakistan government to eliminate India interests from industries and essential installations of the State. But in Delhi this "squeezing-out" of business, as it is termed, is causing concern.

Maraetai Plans

The first three of Maraetai's five power generators should be operating at their full capacity (108,000 kW) early in January. The first to operate should be producing electricity at the beginning of October. These estimates have been given the Minister in charge of the New Zealand State Hydro-Electric Department, Mr. Goosman, by departmental heads. The first generator will begin operating at a 100-ft head, but when the three sets are working, the full head of nearly 200 ft. will be utilised. He stated that the turbine tests should be finished by the end of September under the present plans.

Rivers Potential

Surveys of the Kaituna and the Rangitaiki rivers are soon to be made, Mr. Goosman, the New Zealand Minister of Works, has announced. It is believed that these two rivers could meet the power requirements of the Bay of Plenty area. The Kaituna in particular shows great possibilities, it is reported. The river has its source at Okere, in the outflow of the Rotoiti and Rotorua lakes. From there it falls rapidly to the level country at Paengaroa, near Te Puke. It is estimated that with a head of 900 ft of water the Kaituna could generate 65,000 h.p. Projected industrial developments based on the Murnpara Forests will make a heavy demand on the sources of power available at present. Generating schemes based on the two rivers could rank next in importance to the Waikato stations, supplying electricity to a grid of lines controlled by the Rotorua, Bay of Plenty, Whakatane and Tauranga Power Boards.

Brazil's Railway Plans

Another section of the main railway line from Sao Paulo is to be electrified, it has been announced. The section involved is that between Alianca and Cachoeira Paulista, a distance of 127 kilometres.

PERSONALITIES

IN THE INDUSTRY

The reappointment of **Lord Citrine,** K.B.E., as chairman of the British Electricity Authority, together with **Sir John Hacking,** M.I.E.E., and **Sir Henry Self,** K.C.B., K.C.M.G., K.B.E., as deputy chairman, and two existing part-time members, **Dame Caroline Haslett,** D.B.E., comp.I.E.E., and **Lt.-Col. E. H. E. Woodward,** M.C., T.D., M.I.E.E., was announced by the Minister of Fuel and Power last Thursday. The three Area Board chairmen, Mr. H. H. Mullens (N. Eastern), Mr. H. Nimmo (Southern) and Mr. S. F. Steward (S. Western), with the **Rt. Hon. Thomas Johnston** (N. of Scotland H.E. Board), will continue to be members of the Authority. But two members of the Authority, **Sir William Walker,** J.P., M.I.E.E., M.I.Mech.E., and **Mr. E. W. Bussey,** C.B.E. (member for labour relations and welfare), will retire. Sir William is not being reappointed on account of his age, and Mr. Bussey has tendered his resignation on the ground that following a serious operation he wishes service of a less onerous character. **Councillor J. Sullivan,** now a part-time member of the South-west Scotland Electricity Board, has been appointed a part-time member of the Authority. The other vacancy will be filled shortly. These reappointments and new appointments are for three years, except in the case of Lt.-Col. Woodward, whose reappointment is for two years.

One of the new part-time members of the British Electricity Authority, **Councillor J. Sullivan,** has been a part-time member of the South-West Scotland Electricity Board since 1948, and he now gives up that post. In his new capacity, he will have special interest in labour relation matters, in which he has had extensive experience. He has been on the N.J.I.C. for the Electricity Supply Industry, representing Scotland, and prior to 1948 was a trade group organiser with the Transport and General Workers Union. He had, in fact, been a permanent officer of the T. and G.W.U. since August 1931. He will thus bring to the Authority a wide and comprehensive knowledge of labour and trade union matters which will be of value following the retirement of Mr. E. W. Bussey.

Councillor J. Sullivan

Mr. T. R. Monkhouse, B.E.M., has been appointed manager of the Bristol factory of British Mechanical Productions, Ltd. It will be recalled that that concern and the General Accessories Co., Ltd., were amalgamated with the Edison Swan Electric Co., Ltd., in Sept, 1951, and since January, 1952, all sales have been dealt with by Ediswan. Mr. Monkhouse served in various capacities with Metropolitan Vickers Electrical Co., Ltd., from 1921 to 1943, and was closely associated with the original development of radar from 1938 onwards. He was awarded the British Empire Medal in 1943. From 1944 he was associated with Wm. Gardner and Sons, Gloucester, and Brierley Engineering Co., and Alite Machine Co., Ltd.

Mr. T. R. Monkhouse

Mr. G. H. Dunmore, B.Sc., has been appointed lecturer in electrical engineering at Constantine Technical College, Middlesbrough, as from January 1 next.

Mr. R. N. Millar has been appointed to supervise the mechanical engineering activities in Australia of British General Electric Co. Pty. Ltd., Sydney. He will be responsible for heavy equipment such as turbo-alternator plant, materials handling equipment, coal preparation and mining equipment. For the past five years Mr. Millar has been in South Africa as assistant mechanical engineer of British General Electric Co. Ltd.

Newly appointed manager of the Ipswich branch of British Insulated Callenders' Cables Ltd. is **Mr. L. de Wynter.** He succeeds **Mr. A. R. Driessen,** who is joining the Indian Cable Co. Ltd. as commercial manager. Mr. de Wynter joined the former British Insulated Cables Ltd. in 1932 and subsequently gained wide experience of the company's products when serving in the various departments at Prescot and Helsby Works. He was transferred to the outside staff of the Birmingham branch in 1939 and became senior capacitor sales engineer.

Mr. L. de Wynter

Alderman H J. Galliers, sole proprietor of the well-known Brighton and Worthing electrical contracting concern of the same name, died on July 29, aged 72. He had also been a member of Brighton Town Council for nearly 30 years, and served as chairman of various committees. He founded his own contracting business in 1899 and, with its development, also helped to found the local branch of the Electrical Contractors Association, and was prominently known throughout the industry. Entering municipal affairs in 1923, he was elected Mayor of Brighton for 1928-29, and continued to play an active part in the affairs of the town till a few days before his death. An enthusiastic Rotarian and a prominent man in the town, he was chairman of the Alliance Building Society, which he had seen grow from a small local society to national status, a director of the Brighton and Sussex Building Society, and president or chairman of numerous other business organisations.

In No. 6 sub-area of the Yorkshire Electricity Board, **Mr. G. W. Mitchell,** A.M.I.E.E., has been promoted to the position of sub-area engineer in succession to **Mr. H. Mallalieu,** M.I.E.E., who retired from that post recently. Mr. Mitchell started with the Hull Corporation undertaking in 1919, and was at one time mains superintendent.

At St. George's Hill Golf Club, Weybridge, Surrey, recently, some 50 competitors who took part in the London Area, E.I.B.A., Golf Championship had a thoroughly enjoyable day, although the scoring was not as low as had been anticipated. During the evening **Sir Henry Self,** K.C.B., K.C.M.G., K.B.E., deputy chairman, B.E.A., presented the prizes to successful competitors. These will now represent the London Area in the National Championships to be played at Worthing in October. Of the London Area Golf Committee those present were Messrs. E. Young, chairman, Ivor Williams, secretary and treasurer, E. A. Mills, Eric Beaver, and C. Boyes.

Mr. A. G. Richards, right, receives the scratch prize from Sir Henry Self at the E.I.B.A. London area golf meeting

Just appointed sales manager (Export) Lamps and Lighting for the British Thomson-Houston Company, Ltd., is **Mr. Ian Quigley,** B.SC., A.M.I.E.E. After taking his degree at Glasgow, Mr. Quigley started as a vacation and college apprentice in engineering with Metropolitan-Vickers, completing his course of training with that company in 1926. He then joined the Nigerian Government service where he worked as a telephone and telegraph engineer until 1932. On returning to England he joined the Calico Printers Association, and the following year went to the Central Electricity Board. From 1934 to 1939 he worked as an engineer with the Hotpoint Electric Appliance Co., and he then joined the B.T.H. Lighting Department, where he was concerned principally with infra-red equipment. He became, in 1949, the company's representative on the manufacturers' committees responsible for overseas lamp matters.

Mr. I. Quigley

Councillor Thomas Wilkins, A.M.I.E.E., who had been low-voltage development engineer in the West Central Sub-area of the South Wales Electricity Board, died on July 28. Prior to vesting day, Mr. Wilkins was engineer and manager to the Penybont R.D.C. for 20 years. He was educated at Bridgend Grammar School and gained early engineering training with local collieries.

Mr. G. T. Chippindall, C.B.E., director general, Posts and Telegraphs in the Commonwealth of Australia, has just arrived in the United Kingdom, accompanied by Mrs. Chippindall, and is making a study of the post-war developments in the European postal and telecommunications field, with particular reference to certain major projects facing the Australian postal administration.

We have news that another of our old readers, **Mr. G. H. Gillam,** who was one of those stalwarts engaged with the Hove Electric Lighting Co., and Crompton and Co. in the early pioneering days, celebrated his golden wedding anniversary on Monday of last week. We offer our hearty congratulations to the happy couple. The Hove Electric Lighting Co., as it then was, started operations in November, 1892, the engineers for the scheme being Crompton and Co.

Mr. S. R. Siviour, O.B.E., M.I.E.E., who has been in Uganda for some time assisting the Uganda Electricity Board in planning and organisation problems, has now returned to this country.

OBITUARY

Mr. J. B. Kramer, M.I.E.E., who was in active control of the Witton-Kramer Electric Tool and Hoist Works at Witton, along with the G.E.C., from 1909 until retiring in 1939, died on July 28, aged 77. A pioneer in the field of magnetism as

applied to industry, he was also associated with early work on the photo-electric cell and in television. He also invented numerous devices, particularly in connection with wireless receivers.

Mr. K. F. Kingwell, who was superintendent of the small gear assembly department of the British Thomson-Houston Co., Ltd., from June, 1941, until retiring in October, 1945, died on July 21, aged 71. He started with B.T.H. as a junior draughtsman in 1903, and subsequently served in the meter factory before becoming works manager of Messrs. Sandicroft's foundry at Chester. After war service he returned to B.T.H. in 1919 as apprentice supervisor, and was later, for a time, superintendent of the Personnel Department.

We regret to announce the death on July 28 of **Mr. Ernest Ellwood** of the Manor Electric Co.

Wills.—Mr. Kenneth Ridge Mackley, of 131 Mather Avenue, Liverpool, manager of the Liverpool branch of Cryselco, Ltd., and formerly of Bedford, who died on Feb. 9 last, aged 46 years, left £6,253 5s. 5d. gross, £5,653 14s. 8d. net value.

Mr. George Barnard, M.I.E.E., of "Moorfield", 129 Hagley Road West, Birmingham, for 60 years with Callender's Cable and Construction Co., Ltd., who died on February 7 last, aged 89 years, left £17,793 10s. 10d. gross, £17,654 6s. 11d. net value.

Mr. Albert Neilson Haworth, A.M.I.E.E., of 1 Shipley Avenue, Stretford, Lancs., for many years service engineer (switchgear) to the Metropolitan-Vickers Electrical Co., Ltd., who died on March 13 last, aged 68 years, left £3,344 5s. 5d. gross, £3,301 5s. 8d. net value.

Mr. Ernest George Thibaut, of 35 Rosebery Avenue, Worthing, late of the Calcutta Electric Supply Corporation Ltd., who died on April 21 last, left £4,533 15s. 6d. gross, £4,451 2s. net value.

Mr. Joseph Jones, of 166 Nelton Road, West Bridgford, Notts, founder and chairman of J. Jones and Co. (Nottingham), Ltd., electrical engineers of Canal Street, Nottingham, who died on April 16 last, left £13,925 10s. 6d. gross, £13,776 18s. 2d. net value.

Mr. Richard Charles FitzGibbon, of 18 The Mount, Ewell, Surrey, founder of FitzGibbon and Murray Ltd., who died on May 18 last, left £5,630 6s. 10d. gross, £5,570 9s. 8d. net value.

Auckland Prefers to Look Ahead

ALTHOUGH revenue increased by £35,000 and the units sold were also up by 4,500,000 for the year ended March 31, 1951, the Auckland Electric Power Board, New Zealand, made a loss of £39,000 over the period. Added to the loss from the previous year the accumulated deficit amounted to £57,000. This change in the trading side of the undertaking is due to the restrictions on electricity consumption and the increasing cost of the bulk supply and of various materials. The remedy—the raising of tariffs—was given early consideration.

In all, the Board sold over 390 million units during the year. Of these 204.7 million were for domestic supply at an average of 0.6375d per unit; 18.5 million for lighting at an average of 1.6042d per unit, and 140.4 million for power at an average of 0.6492d per unit.

Mr. N. M. Speer, general manager, points out that while the units sold were some 16 million below the estimated figure, the average return was higher, being 0.0214d above the anticipated figure of 0.6826d. The effect of the severe restrictions was to curtail the use of low rate units, resulting in a higher average return per unit.

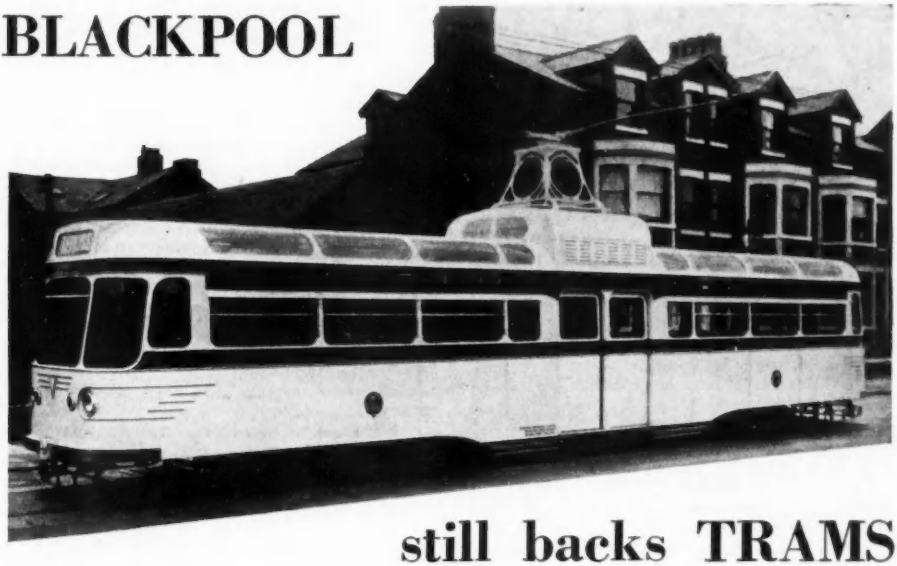
A total of £459,651 was expended in new capital works during the year—the highest amount for such work for many years past, but Mr. A. O. Glasse, chief engineer, reports that shortage of manpower is delaying construction work. In view of the difficulty of acquiring hardwood poles, and taking other matters into consideration, the Board has considered the advisability of adopting underground distribution. Mr. C. T. Lovegrove, chairman, avers that with modern development, overhead distribution is, in many cases, giving way to underground systems. Public opinion will not always allow the cost factor to mar the skyline or the street with poles and wires, he says, adding that with national maturity, a sense of civic pride will develop together with a love of things beautiful and there would be no hesitation in paying the cost of maintaining the improved amenities.

The report records the laying of 23,260 yards of underground cable (some for 22 kV working), and 39,495 yards of overhead line (mostly l.t.), during the twelve months. A table is also included showing the increases in the cost of materials in the past ten years. The largest increase was in respect of galvanised bolts, but some types of cable were 192% up. It is added that the upward trend is continuing!

Comment is also made in the decision of the N.Z. State Hydro Electric Dept., to decline to purchase 5,000-10,000 kW coal burning generating plants from the U.S., bearing in mind the need to add to the country's power supply.

But looking forward to better days when the huge Maraetai hydro electric station begins operating, the Board is planning to further extend its consumer service—although within the limitations of the power restrictions the Board were able to connect up 2,864 more consumers, bringing that total to 87,702. They also added 2,934 water heaters (total 44,955) and 2,909 electric cookers (total 87,702), so that the wattage on the system represented an increase in the connected load of 7.3% for the year.

BLACKPOOL



still backs TRAMS

WHEN London was saying good-bye to the last tramcar, Blackpool Corporation were putting into service the first of 25 of a new class of single-deck cars being built by Charles Roberts and Co., Ltd.

Seating 56 passengers, the tram has a well-type underframe, dropped between the bogies to permit a low central platform with a minimum step height. The body is carried on two Maley and Taunton hornless equal wheel bogies. Each bogie is equipped with two Crompton Parkinson traction motors rated at 45 h.p. at 275 V. All axles are motored, the drive being through cardan shaft and spiral bevel gears.

Resilient type wheels, introduced by Crompton Parkinson, are used in which there is no metal to metal connection between wheel hub and tyre, torque being transmitted and shocks absorbed by large masses of rubber in shear. Normal braking is by rheostatic means, the car being brought finally to rest by air wheel brakes which also serve to hold the car on a gradient. There are also magnetic track brakes for use in emergency.

The control gear is of the Vambac type. The main feature of this is the accelerator, an arrangement of resistance grids in a circular group. A motor-driven arm rotating within this group, switches in succession about 90 control notches. The arm motor is automatically regulated in speed according to the setting of the single driving lever, in conjunction with the control imposed by automatic safeguards to prevent overloading. The arm carries permanent magnets which operate the resistor step switches.

Smooth riding and fine control are features of the new Blackpool tram shown above

The accelerator is similarly used for rheostatic braking. Both acceleration and braking are controlled by the driving lever which is pushed forward or backwards respectively. In each case the rate is automatic and variable, dependent only on the extent to which the lever is moved. Control equipment was built by Allen West and Co., Ltd.

Air brakes can be operated by the conductor independently of the driver by using a small lever mounted on the door jamb of the central platform, this brake being also provided with a "fail-on" which operates automatically in the event of any damage to the piping.

The trolley boom is carried on a tower, over the main centre platform, which also houses the accelerator unit.

The overall length of the car is 50 ft, and the distance between bogie pivot centres 25 ft. The bogie wheel base is 6 ft and the diameter of the wheels 2 ft. Overall height from rail to top of roof is 9 ft 11⅝ in., the interior height in each saloon is 6 ft 10 in., and the length 18 ft. The overall width of the car is 7 ft 11 in. and the minimum clearance from underframe to rail level 6¼ in. The maximum running speed is estimated at 40-45 m.p.h.

The BUYER'S *Column*

Miners' Safer Cap Lamps

FOLLOWING investigations into the causes of electrolyte leakage from miners' cap lamps, NIFE BATTERIES, of Redditch, Worcs., have just introduced a new nylon safety vent which ensures that all alkaline cap lamps can now be operated in a completely dry external condition.

Vent leakage was found to be due to one or more of four different causes—spraying during charging, the pressure ejection of liquid through the vent while the lamp is in service, over topping-up and badly fitting seating washers.

The new Nife nylon safety vent is said to eliminate all these faults and has replaced the original type of steel vent.

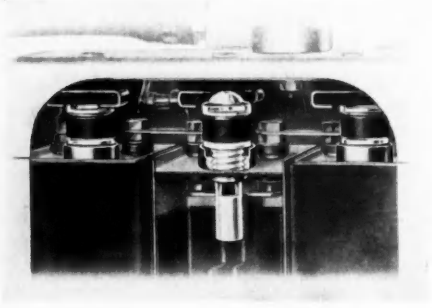
The opening of a Nife cap-lamp battery lid now automatically opens the central orifice of each vent so that charging gases can escape without hindrance. The body of the vent contains two columns of unequal height, and these, combined with a self-draining slot and a free gas exit, remove all possibility of electrolyte spray. At the end of the charge the cells are at atmospheric pressure and their tops completely dry.

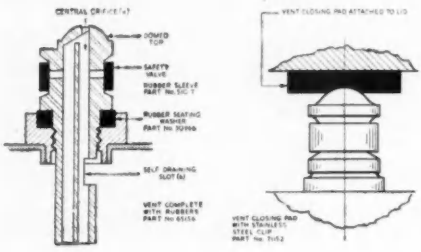
On closing the battery lid the cells are sealed at atmospheric pressure.

It is now no longer necessary to remove the vents before topping-up. This operation is carried out through the central orifice by means of the special Nife topping-up equipment, which cuts off the flow of water automatically as soon as the correct electrolyte level is reached.

The introduction of the new vent system, adaptable to all Nife three-cell cap lamps, offers many advantages. Maintenance is easier, costs are reduced by the absence of spillage, and there are no moving parts to go wrong.

The new nylon vent is well illustrated in these pictures




CENTRAL ORIFICE (x)
DOMED TOP
SAFETY VALVE
RUBBER SLEEVE PART No. SIC 7
RUBBER SEATING WASHER PART No. X2986
SELF DRAINING SLOT (x)
VENT COMPLETE WITH RUBBERS PART No. 61656
VENT CLOSING PAD ATTACHED TO LID
VENT CLOSING PAD WITH STAINLESS STEEL CLIP PART No. 7652

A New Pressure Cooker

WE understand that METWAY ELECTRICAL INDUSTRIES, LTD., 21 King Street, Brighton, Sussex, will shortly put into full production a new model pressure cooker.

Details will be published in the near future.

Hot Water "Servis"

HOUSEWIVES who for years have been pleased with the efficiency and quality of the "Servis" washing machine made by WILKINS AND MITCHELL, LTD., Darlaston, Staffs, will be pleased to hear that the company have now introduced a version of the "Servis" washing machine which is fitted with a special 3 kW heating element which heats the water to washing temperature conveniently and without effort.

Water heating Servis model differs little from standard types

The exterior of the new model is identical with previous designs apart from the provision of extra switch equipment.

T.V. Sets Reduced in Price

REDUCED prices for two current television receivers have been announced by THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. The BT 5145 12-in. table model is reduced in price from 75 gns. to 67 gns. (including £21 16s. 1d. purchase tax); the BT 4542 12-in. console model from £95 to 87 gns. (including £28 6s. 3d. purchase tax). These lower prices are operative from July 25, 1952. Arrangements have been made for all G.E.C. distributors to claim rebate on any stocks held.

Hurseals Help Televiewing

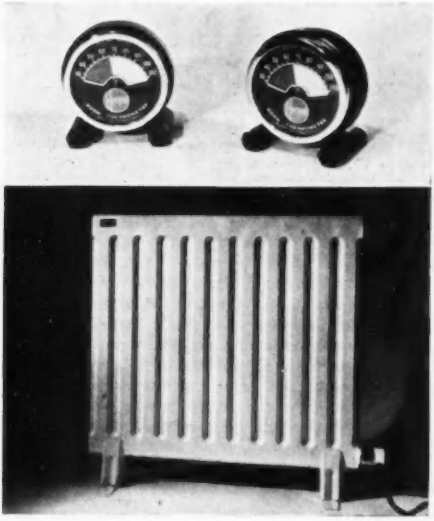
BEARING in mind the distraction when viewing television programmes caused by a flickering coal fire and by the image of the glowing coals or electric and gas fire elements reflected in the glass of the cathode ray tube, HURSEAL, LTD., 229 Regent Street, London S.W.1, have now introduced a version of their well-known panel heater fitted with feet.

This unit, which supplies heat without light in any position where it is required, will prove welcome with the advent of longer cooler evenings. It also has the added advantage of requiring no attention or extra care in positioning and affords undisturbed televiewing for users. Truly portable because of its lightness and dimensions, it can be used anywhere in halls, dining-rooms, spare bedrooms or to supplement existing heating arrangements in an economic unobtrusive manner.

The heating element being totally enclosed ensures absolute safety, installation costs are negligible and maintenance almost unnecessary.

Standard radiators are available in a number of sections and in various sizes. They are supplied in priming coat ready for painting to suit individual colour schemes or finished in cream or bronze.

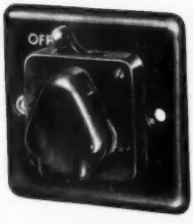
Another recent introduction by Hurseal is the improved design of the Room Thermometer, made to operate between 30° and 110° F. on a positive bimetallic thermostatic principle with a movable dial. Casing is metal and Bakelite. List price is £1 17s. 6d.



The well-designed Hurseal Room Thermometer helps to check the efficiency of the Hurseal panel heater now on feet for portability

New Lundberg 5-amp Switch Sockets

FOLLOWING on the introduction of Lundberg 13-amp a.c. switch sockets which we mentioned in our issue 6 March, SIMPLEX ELECTRIC CO., LTD., Broadwell, Oldbury, Birmingham, have now added new 5-amp a.c. switch sockets to the Lundberg range of accessories.



Cat. No. 51400 is the flush type 5-amp switch socket

Designed for surface and flush mounting, the new switch sockets embody the same ingenious construction of the switch movement as the 13-amp types which, by permitting the placing of the switch dolly in a position where it escapes injury, also reduces the dimensions.

Again the new models have the same dimensions: 2 by 2 by $1\frac{5}{16}$ in. for the surface pattern (Cat. No. 51200), and $3\frac{1}{4}$ by $3\frac{1}{4}$ in. for the flush pattern (Cat. No. 51400).

The sockets finished in brown synthetic resin are protected with shutters. The surface type has four knock-outs for installation, whilst the flush type fits BS 1299 boxes. Price at time of going to press is 10s.

Prepare for Autumn Warmth

BEFORE long summer will be at an end, and with winter soon to follow wise dealers will be stocking up with for winter use appliances.

Electric blankets both safeguard health by preventing chill, damp beds, and induce health-giving sleep. However, many people object to the use of electric blankets because some models are intended for use as an over-blanket and tend to overheat the body and cramp movement.

Not so the "Yelsen De Luxe" blanket, which is used as an under-blanket and need not be removed before entering the bed.

Principal features claimed by YELSEN LTD., 9 Hatherley Road, Sidcup, Kent, are that the blankets can be switched on and off whilst lying upon them, are definitely full-length models, have envelopes made from 100% virgin merino wool which is of exceptional strength, is not subject to local overheating and burning due to stretching and shrinkage associated with felt and other fabrics; are shockproof, liquid repellent and mothproof; give 9 hours warmth at a maximum of 130° F for approximately one penny on single-size model; have individual control on each side of double-bed model, and are supplied in three colours—camel, sky blue and rose pink.

For use in the following voltages: 100/120, 200/220, 230/250 V. The blankets are available as follows: Double (60 in. by 42 in.), loading 158 W, £11 plus £2 13s. purchase tax. Single (60 in. by 28 in.), loading 112 W, £7 10s. plus £1 16s. purchase tax. Junior (40 in. by 20 in.), loading 50 W, £4, plus 19s. 3d. purchase tax.

D

NEW LITERATURE

Fractional H.P. Electric Motors

by F. G. Spreadbury

QUITE a number of books on f.h.p. motors have been published during the last two years. Mr. Spreadbury's useful contribution differs from most in concentrating on design and construction rather than on characteristics and application. In developing this approach, he covers most of the ground that would be expected in a general textbook on electric motors, but illustrates his points always with reference to f.h.p. designs. The approach is largely mathematical, though the techniques invoked do not extend beyond simple calculus. In the last two chapters there are some helpful notes on test methods and on available means of speed control. Published by Pitman, 342 pages, 8½ in. by 5½ in. Price 35s.

The Nature of Polyphase Induction Motors

by P. L. Alger

IN the series of text-cum-reference books being prepared by the engineers of the American General Electric Co., there is a common method of attack. Some aspect of electrical engineering is taken, and the usually accepted theory is examined in relation to the fundamentals of physical science. In the process, the mathematics and philosophy scattered over some hundreds of specialist papers in the proceedings of learned institutions are concentrated. Yet touch with the engineer's problems is never completely lost.

This examination of the induction motor, written to clarify its characteristics for the post-graduate student, runs true to this form. In the first three chapters, the usual analysis is applied with more attention to fundamentals than is usual. Then general properties, calculations and design are discussed; a detailed investigation of reactance, crawling and locking, speed/torque relationships and magnetic noise follow, with a down-to-earth statement of rating principles concluding. A final chapter discusses Kron's tensor analysis technique. Published by Chapman and Hall, 397 pages, 9 in. by 6 in. Price 60s.

The Sterling Area

THE need for a thorough, and reliable, explanation of the complex economic problems affecting the Sterling area countries has been obvious for some time, for despite the issue of White Papers and similar publications, much of the factual background has remained clouded for many. The present weighty volume should meet that need admirably. It starts off on the right foot by giving a brief historical background of the formation of the British Empire (without any "frills") and of the resulting interlinking of the various countries with the British monetary system. There follows details of the pattern of international trade which has developed and an examination of the relation between American business conditions and the area's trade. Much of this explanatory matter, along with notes on measures taken to deal with the dollar gap, are given in the first section of the book. The next section deals with the various overseas members of the Sterling area while the third provides statistics of various commodities and raw materials, their production, imports and exports. As an exhaustive study of many of the present-day problems between "Sterling" and "dollar" countries, this 672-page work has no equal as far as we are aware. There are numerous tables and charts providing readily comparable data; the work has been splendidly written and admirably prepared. Our only small criticism is that many of the trade figures are not very up-to-date. The volume has been prepared by the research staff of the Economic Co-operation Administration Mission to the U.K., predecessor of the present M.S.A. mission, and is published by H.M. Stationery office, price £1 1s.

Alternating Current Machines

by H. Cotton, M.B.E., D.SC., M.I.E.E.

PROFESSOR COTTON'S lengthening list of textbooks are marked by one special characteristic. Each exceeds its predecessor not only in topicality, but also in clarity and conciseness. This present volume, the fourth of Messrs. Cleaver-Hume's "Electrical Series," is intended especially for students for the intermediate City and Guilds examination, but it must surely prove popular with a wider audience.

For once, the transformer is excluded from the list of electrical machines, and the space made available is used for a longer description of commutator motors and single-phase machines than is usually possible. Though machine theory receives the attention necessary for the purpose in hand, it is in description and illustration that the book is strongest. Published by the Cleaver-Hume Press Ltd., 303 pages, 7¼ in. by 5 in. Price 10s. 6d.

Servo-mechanisms

FROM time to time selected reports emanating from Government research establishments are published in book form for the convenience of industry. This present series covers work on servo-mechanisms from 1944-47, and deals with a wide range of subjects from basic theory to practical detail. Seventeen reports are reproduced, of which five deal with necessary mathematical techniques, and five with electrical machines and circuits. Probably the first two reports are of the widest value. They deal, respectively, with the interpretation and use of Nyquist diagrams, and with operational methods for use in analysing servo systems. Published by H.M. Stationery Office as Volume 5, Selected Government Research Reports, 293 pages, 9½ in. by 6 in. Price 63s.

The WEEK in NEWS

Increased Use of Electricity Demanded

Consumption on New Estates too small

CONCERN about the consumption of electricity in the Midlands continues. Latest reports on the subject come from Dudley, where on the corporation's new housing estates the small amount of electricity used is causing the Midlands Electricity Board some anxiety. The Board has pointed out the consumption is very much less than was anticipated and consequently revenue bore no satisfactory relationship to the amount spent on new sub-stations, mains and services. The Board has authority to ask councils for contributions towards the cost of supplying electricity to new estates, but it is loathe to do this if other satisfactory arrangements can be made.

Accordingly, some suggestions have been laid before Dudley's Council. One is that all houses should be provided with facilities for electric cookers and wash-boilers. For a small additional charge a cable could be fixed in the kitchen and wiring sealed off so that should the tenant want an electric cooker instead of gas there would be no difficulty in arranging the changeover.

The plan to encourage the greater use of electricity has been adopted by the Housing Committee, who are submitting it to the Council. The Committee proposes that tenants themselves should be responsible for the cost of installing the cookers or wash-boilers.

Permanent Rank for Electrical Officers

NATIONAL Service electrical officers in the R.N.V.R. can in future apply for permanent commissions in the Royal Navy under the University Candidate scheme of entry. An Admiralty Fleet Order announcing this has just been issued.

Conditions of entry will be identical with those applying to University candidates who are not doing their National Service. Certain time served as temporary officers, however, will be considered for seniority purposes.

ELECTRIC LOCOS FOR GOLD COAST

FOLLOWING closely upon the recent conference of Colonial railway chief mechanical engineers to discuss future standards for their narrow-gauge tracks, the English Electric Co. have announced the acquisition of an order for locomotives for the Gold Coast. The contract involves ten diesel electric engines each of 750 h.p. They weigh 52 tons and are designed for passenger or freight services. Power will be transmitted to the wheels by means of four traction motors and provision made for multiple-unit operation.

CLOSED SHOP DISPUTE AT DURHAM NOW CLOSED

THERE is every reason to suppose that the closed-shop dispute which has been going on in Durham for well over a year has at last been settled. Not very long ago agreement was reached on all but one matter and both parties, the County Council and the Joint Emergency Committee of the Professions, decided to submit their cases to a Board of Arbitration agreeing at the same time to accept the Board's decision. The Minister of Labour accordingly appointed such a Board.

The matter to be decided concerned the council's regulations requiring applications for extended sick pay to be made through a trade union or professional organisation. The Board concluded that this regulation conflicted with the principle of voluntary membership and should therefore be withdrawn. Durham C.C. has been told to drop their closed-shop policy. It will be recalled that the council insisted that professional employees should belong to an appropriate union, but had to withdraw this rule under pressure from the previous Government. It was then that the regulations regarding extended sick pay were made.

The First Half-Century

For some years there has been something rotten in the state of the wiring business. Most young industries have to run the gauntlet of troubles incidental to infancy: they are overrun with incompetents who have failed in other trades, and who do bad work at less than starvation prices, thereby taking bread out of the mouths of their more respectable competitors and bringing the industry into bad repute. In due course the detrimentals find their way into the bankruptcy court, but the evil that they do lives after them, and it takes time before the effects of their invasion are eradicated.—*From our issue of August* 7, 1902.

Early Arrangements for Coronation

A FEW preliminary facts about plans for the Coronation were given last Friday by the Minister of Works, Mr. David Eccles. For the most part they were general and concerned stand accommodation being provided along the route for some 98,000 persons.

As regards floodlighting, the Minister said that schemes for the illumination of numerous Government buildings were being prepared and expressed the hope that owners of other prominent buildings in London and elsewhere would make similar arrangements. The extent of floodlighting schemes would be governed largely by the cost of equipment, though advantage lay in the fact that much of the materials used during the Festival were still in place.

A representative of the National Chamber of Trade suggested that Electricity Boards should be approached to grant concessionary tariffs during Coronation week for floodlighting and shop-window decoration. The question was prompted, he said, by existing high tariffs. Mr. Eccles promised to consider the proposition.

STREET LIGHTING BY GAS

A QUESTION has arisen in connection with the loss of gas in street lighting. In referring to a recent meeting of the North-western Gas Consultative Council we reported a statement to the effect that wastage from leakages resulted in gas being uneconomical for this purpose. We have now received a letter from the chairman, Councillor C. E. P. Stott, stating that the point made at the meeting concerned the lack of metering of gas used for normal street lighting. The consumption was consequently calculated on the assumption that a particular type of burner consumed a given quantity and it was this that was materially responsible for "unaccounted-for" gas. If our report of the meeting erred we apologise, but our information was obtained from two sources which gave materially similar accounts of the meeting.

Copper Price £285 for at least 6 weeks

AS a result of negotiations concluded between the Ministry of Materials and Commonwealth suppliers, the selling price of copper is to be reduced by £2 to £285 a ton, delivered to consumers' works. Discounts and premiums remain unaltered. This was announced by the Ministry last week. The arrangements made provide for a fixed price which will remain in force for at least six weeks and afterwards unless any of the parties give notice of a desire to re-negotiate due to altered circumstances.

OFFICIAL PUBLICATIONS

BRITISH STANDARDS
B.S. 1872: *Electroplated coatings of tin.* B.S. 1875: *Bi-pin lamp-caps and lamp-holders for tubular fluorescent lamps.*

NOTIFICATION OF VACANCIES (AMENDMENT) ORDER 1952. S.I. No. 1402. (*See page* 249.)
H.M.S.O., 2d.

MOBILE SHOWROOM IDEA ADOPTED IN TRINIDAD

THE introduction of mobile service centres in this country has proved a useful and valuable innovation. It may well be that news of their success has been voiced abroad, but whether or not this is so we note that the Trinidad and Tobago Electricity Commission has adopted the idea and recently put one such centre into operation. Its usefulness should prove even more valuable in the Commission's outlying districts than in Britain.

The van is to tour the Colony to enable consumers to pay their bills locally and to seek advice and see demonstrations of equipment. The unit has also been arranged to give film shows during the evening, and a number of E.D.A. films have been obtained for the purpose. Our accompanying illustrations show the new centre making its debut at Couva, one of the centres of the Colony's sugar industry.

Interior and exterior of the new mobile service centre brought into operation recently by the Trinidad and Tobago Electricity Commission

VACATION SCHOOL ON INSULATION

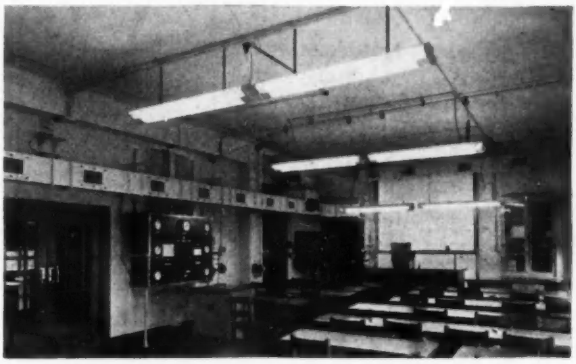
INSULATION of electrical equipment provides the subject for a five-day vacation course to be held from September 15 to 19 at the Imperial College of Science and Technology. The object of the school is to consider the factors which are limiting insulation design in the main classes of electrical equipment, and the general principles which should govern the approach to the solution of outstanding problems in this field. Scientists and engineers from industry, government establishments and research departments will be giving lectures on various aspects of the subject, which will concentrate largely on electrical power equipment, although touching on communication problems. The school will conclude with discussions of the points thrown into prominence during the week.

Batti-Wallahs told of Companionship at Sea

SIR PATRICK HANNEN, principal guest at the Batti-Wallahs luncheon last week, took as his theme "Companionship at Sea," and most ingeniously elaborated this topic to cover well nigh the whole field of international trade and economics. He laid particular emphasis on the necessity for retaining the comradeship of the sea as exemplified by the Batti-Wallahs themselves. The next luncheon will be held on September 24, when the speaker will be Mr. J. Boyd Carpenter, financial secretary to the Treasury.

1s. 6d. IN £ BONUS

JULY the 25th was a red-letter day for some 1,500 employees at the Wolverhampton works of the Electric Construction Co., Ltd. Those who had been in the company's employ for 12 months at the end of the last financial year received a bonus in the profit-sharing scheme. Employees' share amounted to some 1s. 6d. in the £ on wages.



Lighting laboratory at London's School of Hygiene

Lighting in the Interests of Health

IT is acknowledged now that lighting and ventilation are important aspects of health, so much so that instruction and research carried out at the London School of Hygiene and Tropical Medicine is now organising courses on the problems of lighting, ventilation and general welfare in such places as schools, offices and industrial premises. In consequence, a lighting laboratory and lecture theatre has been fitted with suitable fittings and we note that those chosen were fluorescent fittings of standard design, supplied by the British Thomson-Houston Co., Ltd. They are normally used in offices, shops, hotels and the like, and have fluted "Perspex" side-panels acting as diffusers and combine with transverse louvres to screen the lamp from view.

The fittings have been specially constructed, and have easily detachable side-panels and louvres arranged on suitable hoist gear. This enables the ill-effects of glare when tubes are not properly screened, or when the tubes are at too low a level to be demonstrated.

MORE WORKERS WANTED

WHILE some firms throughout the country are finding it necessary to reduce their staffs temporarily or permanently for one reason or another, it is a change to report one where the reverse is almost true. Presenting prizes to apprentices recently, Sir Claude Gibb, chairman and managing director, said C. A. Parsons and Co., Ltd., had the largest order book in its history and could employ another 300 fitters, turners, welders, moulders and pattern-makers, if they could be obtained. The shortage of skilled workers, he said, was worse than the shortage of materials.

AMENDMENT TO RULE FOR ADVERTISING POSTS

AS from Monday next employers will not have to include in an advertisement for workers a statement that applications would have to be made through an employment exchange or registered agency. An order giving effect to this reversion of procedure was made by Sir Walter Monckton, Minister of Labour, last week. Under the Notification of Vacancies Order, 1952, employers were allowed to advertise for workers only if the advertisement contained such a requirement.

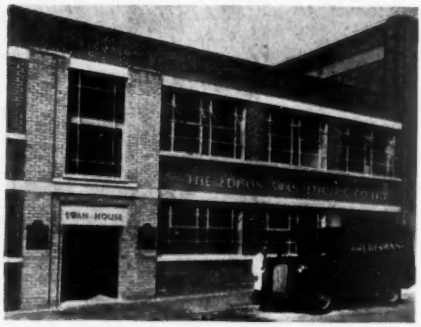
The basic principle of the original order remains unaltered but allows newspapers and magazines to publish one prefatory announcement. This will suffice to satisfy the requirements of the amended order.

Exhibition of Building Materials

WE note that the biennial Public Works and Municipal Services Congress and Exhibition is to take place in London between November 3 and 8 next. Even at this early stage it can be seen that there will be a most comprehensive group of exhibits which will bring information on latest available equipment up-to-date for local authorities. Exhibits include a miscellany of power-driven apparatus—electric motors, electrically driven dumpers and loaders, pumping or generating sets—and street-lighting equipment. Full information on the exhibition and congress may be had from the Municipal Agency, Ltd., 68 Victoria Street, London S.W.1.

RECTIFIERS FOR S.R.

IN our issue of July 10 we gave a brief account of the change-over from 25 to 50 c/s to be carried out on the Southern Region of British Railways. The contractors for the rectifier equipment were quoted as being "Hackbridge and Hewittic Electric Co., G.E.C. and B.T.H." This should have read, "Hackbridge and Hewittic Electric Co., G.E.C. and the English Electric Co., Ltd." We regret any misapprehension which may have arisen due to this error of transcription.



Our " illustration shows Edison Swan's new Birmingham office at Swan House, 10 Hospital Street, recently acquired. The office began to function on July 21 and all future enquiries should be addressed there. The new premises include a trade counter. Telephone number: Central 6411/2

One Scottish Electricity Authority?

THE proposal that a single electricity authority for Scotland may be set up has again been given publicity by Mr. James Stuart, Secretary of State for Scotland. At a meeting of Scots Unionist M.P.s last week, he said there was a possibility that a Bill to provide for uniting the two area boards with the North of Scotland Hydro-electric Bill, might be put forward by the Government in the next session of Parliament, although he warned that the session was expected to be crowded. If this is, indeed, official policy, it is surprising that the announcement was made in this form. Further, Mr. Tom Johnson, who is known to oppose strongly any such amalgamation, has been strangely quiet if this threat is imminent.

Simplex Electric's current window display showing Creda cookers at the London showrooms in Tottenham Court Road. Humorous drawings add weight to the argument "You Need a Creda"

NEWS IN BRIEF

"Three-phase Anode Inductors"

WE have been asked by Mr. F. T. Bennell to point out that the caption under Fig. 3 in his article on "Three-phase Anode Inductors" should read "Three-anode commutation. Effect of d.c. current increase $I'd$ shown dotted."

A meeting took place in Manchester recently to discuss the presentation of a second Fuel Efficiency Exhibition in that city in November, 1953. It was held at the invitation of Provincial Exhibitions, Ltd., and it was agreed to proceed with arrangements. Mr. F. W. Woodfield of Babcock and Wilcox, Ltd. is chairman of the Advisory Committee.

Controversy about London's meter-readers has reached a further stage with the dismissal of another 26 men. Reason for this action was that the men were redundant. All were given a month's notice instead of the week to which they were entitled.

Mr. C. H. Crowlie, export sales manager of Hoover, Ltd., and director of Hoover (Washing Machines), Ltd., has just returned from a three-week tour of Australia and U.S. He and ten other export executives flew 160,000 miles in six months and visited 60 countries.

Members of Swinton and Pendlebury Council recently visited Agecroft high-pressure station to view methods in operation to combat atmospheric pollution.

Questions in Parliament . . .

Industrial Development in Lancs.

Concerning the furtherance of Government policy to encourage diversification of industry in Lancashire, Mr. P. Thorneycroft said agreement had been reached on extension in some of the worst hit towns of the three engineering firms. These included the General Electric Co. at Shaw, and the British Thomson-Houston Co. Ltd. at Nelson. These projects would be housed in existing premises and would, it was hoped, eventually provide additional employment for about 2,000 persons. It was hoped also that other firms would be persuaded to follow their example.

Monopolies Commission

In a written answer on Thursday, Mr. P. Thorneycroft, stated that he hoped to be ready to make an announcement on questions he intended to ask the Monopolies Commission to report on under Section 15 of the Act, shortly after the House reassembled.

West Country's TV Service

The Assistant Postmaster-General said he had been informed by the B.B.C. that it would not be possible to find a site from which satisfactory TV service could be given over the whole of Cornwall as well as those parts of Devon outside the effective range of Wenvoe.

Cost of Wenvoe

Asked concerning the anticipated cost of building the Wenvoe TV station, Mr. D. Gammans said the B.B.C. had told him that the estimated total cost of the station was £320,000.

Radio and TV in Scotland

Mr. David Gammans stated last week that nearly 21,000 television licences were current in Scotland at the end of June, but he was unable to give the number of sets in use. Asked about poor reception and the introduction of V.H.F. wavelengths, he said V.H.F. broadcasting could not be envisaged while the restriction on capital investment existed. The technical problems involved were to be considered by the committee which was also to advise on television. Mr. Gammans went on to say that the new Kirk o'Shotts transmitter would not be a guarantee of better reception, although it should bring about an improvement.

Private Trading in Lead

Answering questions following the reopening of the lead market the Secretary for Overseas Trade stated there would be no restrictions on purchases of imported lead through the metal Exchange. Substantial earnings in foreign currencies generally should result and offset any risk of dollar losses. He added that while dollars would be freely available for imports, action would be taken to prevent deliberate evasion of Exchange Control Regulations. Arrangements for private imports other than through the Metal Exchange would be announced shortly.

H.-E. Board's Expenditure

Mr. G. Nabarro asked about the aggregate capital expenditure of the N. of Scotland H.-E. Board. The Secretary of State for Scotland said in 1951 it was £11,409,786. The estimated figure for 1952 was £14 million. Mr. Stuart continued, in answer to a second question, that he had been informed that capital expenditure to June 30, 1952, on completed hydro-electric schemes was £35,852,000; that incompleted schemes on which work had begun were estimated to cost £39,500,000, and that schemes authorised but not yet begun were estimated to cost £800,000. As regards transmission and distribution, expenditure over the whole area amounted to £5,902,000 and £18,188,000 respectively at June 30.

Quality of Export

Following recent complaints concerning the quality of British exports, Lt.-Col. Lipton asked last week whether the formation of an export standards bureau could be considered to supervise and improve the quality of goods sent abroad. The President of the Board of Trade rejected the suggestion, maintaining that Britain produced better goods than anybody else in the world.

Electricity Charges in Rossendale

The alleged deterrent effect of new industrial tariffs on Merseyside has been supplemented by a similar question on the adverse effect of the increased cost of electricity on the textile industry in the Rossendale Valley. Mr. P. Thorneycroft replied that he was aware of the affect of the new charges on the textile industry in general, but understood that discussions were taking place between the textile industry concerned and the N. Western Electricity Board. He could not say whether negotiations affected other parts of Lancashire.

Nationalised Industries

Discussing the business of the House when it reassembles in October, Mr. H. Crookshank said three days would be allocated for debates on the nationalised boards. As regards the procedure for asking questions on the nationalised industries he said he could make no statement until the appropriate committee had reported.

District-Heating Report

Mr. G. Lloyd stated in the Commons last week that he had been informed that the Report on District Heating was due to be published later in the year as volumes 31 and 32 in the series of Post-War Building Studies. The report is by the Heating and Ventilation (Reconstruction) Committee of the Building Research Board of D.S.I.R.

Royal Assent

Mr. Speaker told the House on Friday that the Royal Assent had been granted to the Heating Appliances (Fireguards) Act, the Disposal of Uncollected Goods Act, and the N. Wales Hydro-Electric Power Act.

Electric Supply News . . .

Bath

The Planning Committee has reported that the Minister of Fuel and Power had refused to permit the South Western Electricity Board to place an overhead line across land on Bradford Road housing estate, but had granted permission for o.h. lines from the junction of Locksbrook Road with Osborne Road to Weston "island," and to the caravan site at Quarry Farm, Claverton Down, from the adjoining highway.

Newport

At the local meeting of the Monmouthshire County Executive of the National Farmers Union, it was stated that persons objecting to the proposal to erect a new generating station at Lower Machen, had to lodge an objection by August 11. A member of the Union who was affected had been notified and an objection made out. It was stated that the position at the moment was that no application had been made for a compulsory purchase order and no official body could lodge an objection unless there was such an application. Earlier an electricity consultant from N.F.U. headquarters visited Newport and prepared technical data.

North of Scotland

Protests against what were described as "the exorbitant guarantee" demanded by the North of Scotland Hydro Electric Board for providing a supply to crofters, were made at a meeting last week near Dornock. Statements from potential consumers are to be submitted to the Earl of Home, Minister of State for Scotland. In the crofters' petition to the Minister, the board are to be asked to fulfil their promise of two years ago that no guarantees would be asked. Failing that, the suggestion would be made that the maximum guarantee should be £12 a year for seven years.

North Yorkshire

The Ministry of Fuel and Power has granted compulsory wayleaves to the North-Eastern Electricity Board to supply electricity to Danby Wiske and Wiske Moor. When an inquiry was held into the scheme in May, it was stated that a farmer was refusing to issue wayleaves for the erection of poles on his land. He complained that he already had 14 poles carrying overhead cables on his land and objected to any more being erected.

Perth

The Town Council has approved the recommendation of the Housing Committee that negotiations be opened with the North of Scotland Hydro-Electric Board regarding a supply to houses at the Letham estate on the basis that half of the number should be all-electric, provided no service charge was made for all houses in the scheme. During discussion on the proposal one member, who is also a member of the Gas Consultative Council, urged that electricity and gas services should be installed, leaving the tenant to decide on whether to have gas or electric cooker and wash boiler. It was explained that a sub-committee had studied the question. The H.E. Board had originally suggested 65% of the houses should be all-electric, but had agreed to a 50-50 basis. To do away with cookers and boilers would mean that those tenants would have to get lower rents compared with those with such appliances installed.

Southern Division

Total cost per unit generated by the Southern Division of the B.E.A. during the year ended March 31 last was 0·6473d., it is now revealed. This compares with 0·647d. in 1950/51, 0·6607d. in 1949/50 and 0·6637d. in 1948/49. The total of units sent out in the period to March 31 last was 1,985 millions, some 463 millions more than in the previous year, the comparative plant output capacity being 565 MW and 443 MW respectively. The reduction in operational costs has been achieved despite increases in the price of fuel. This achievement, it is claimed, is mainly due to the operation of the new power station at Poole, which sent out 28% of the Division's total units, with a thermal efficiency of 27·68%. The Division's thermal efficiency has, in fact, risen from 20·85% in 1948/49 to 22·80% for 1951/52, while the fuel consumption per unit sent out also improved from 1·47 lb in 1948/49 to 1·28 lb in 1951/52.

Sussex

The Society of Sussex Downsmen are supporting an objection raised by the East Sussex County Council to two proposals to erect overhead electricity lines on the South Downs, in the area administered by the Cuckfield Rural Council. The proposal to erect the lines is made on behalf of the Air Ministry. The County Planning Committee have asked to be heard on the matter unless it is agreed to put the lines underground.

LIGHTING SCHEMES

Billericay.—Concerned at the terms of a contract offered by the North Thames Gas Board, the U.D.C. is considering changing street lighting to electricity.

Blackpool.—T.C. has approved a scheme, to cost £59,200, for improved lighting in certain streets.

Bolton.—The T.C.'s application to borrow £12,480 for improving lighting in Withins-lane, Ainsworth-lane, Spa Road and Crompton Way has been rejected, but permission has been granted to borrow £3,000 for half the scheme of improved lighting on Crompton Way. A deputation is to see an official of the M.o.T. on the matter. The Lighting Committee has decided to install sodium vapour lighting along Moncrieffe Street and Orlando Bridge, subject to approval of the Finance Committee.

Company Activities . . .

Cable and Wireless

For the year to March 31 last there was a surplus of £1,481,649 (*£2,232,743*) before appropriations for taxation and the dividend. The latter has been reduced from 4% to 2½%, for the provision for future taxation on the profit for the year and deferred taxation, requires in all £1,016,989, leaving a balance of £464,660, which is insufficient to meet the customary dividend of 4%, it is noted. To maintain that rate of dividend for the previous year it was necessary to draw on the balance of profit and loss account brought forward, but in view of the company's general financial position and the present trends of revenue, etc., the dividend for 1951/52 has been restricted to within the earnings for the year, the directors state.

Electric Construction Co.

The consolidated gross profit for the year ended March 31 last is £535,884, compared with £506,773 for the previous period. After allowing for general charges, pension scheme, directors' fees, depreciation, etc., the profit before taxation is £233,155 (*£222,069*). Taxation takes £136,537 (*£122,930*), less excess provision in previous years of £3,605 (*£8,156*), leaving a net profit applicable to the Electric Construction Co. of £89,373 (*£97,369*). There is £20,000 (*same*) transferred to general reserve, £30,000 (*£20,000*) to plant replacement reserve, and the Ordinary dividend of 15% absorbs £27,145, leaving £60,805 carried forward. Orders at present on the books constitute a record for the company, Mr. William M. Furniss, chairman and managing director, states. For a period of about four months during the year the shortage of certain raw materials retarded production. The factory is now working to full capacity.

General Electric Co.

The full accounts for the year to March 31 last show current assets totalling £53,207,964 (*£42,860,339*), of which trade and other debtors account for £14,383,851 (*£12,908,887*), and stocks and work in progress £33,541,257 (*£25,247,010*). In addition there are investments valued at £2,740,015 (*£2,155,937*), and property and plant at £11,656,735 (*£10,234,710*). Current liabilities total £21,830,548 (*£17,559,912*). The group profit on trading for the year was £8,617,275 (*£7,424,716*) which, with investment income, is raised to £8,793,215 (*£7,576,559*). To depreciation £1,092,896 (*£1,038,724*), pension fund £316,105 (*£283,019*), unascertained liabilities £366,345 (*£188,812*), and interest on loans £284,192 (*£284,081*), leaving an aggregate profit of £6,603,957 (*£5,651,418*). The year ended with a record in production and a record order book, states Sir Harry Railing, chairman. The increase shown in stock and work in progress are the outcome of the higher volume of production and of increases in raw material costs and labour rates.

Scottish Cables

Consent of the Treasury has been obtained to the issue to Ordinary stockholders of a scrip bonus of one new Ordinary share for each existing issue 4s. stock unit.

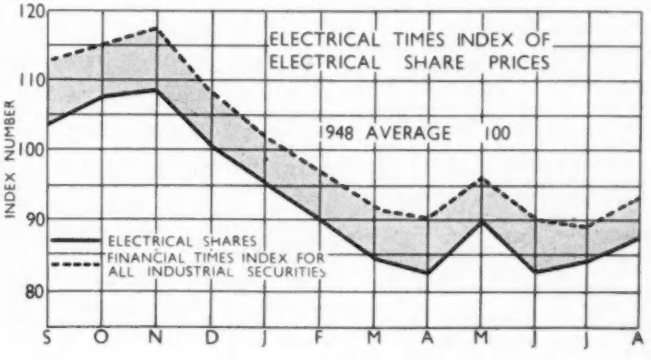
It is recommended that the share premium account amounting to £206,772 should be used for paying up the new shares, and that the balance should be provided as to £21,240 out of E.P.T. Post-War Refund and as to £63,655 out of General Reserve.

In order to ensure that the terms of the company's Articles of Association permit the share premium account to be so used it is proposed to add an express provision to the relevant Article.

John Thompson

Applications for the 687,959 Ordinary shares offered at 14s. 6d. each, exceed the amount available by 482,463, it has been announced. All applications for excess shares up to 20 have been accepted in full, but those for larger numbers have been considerably scaled down.

The general trend in share prices over the past few months was reversed during July, and the indices used for the purpose of our graphs showed a marked rise. The "Financial Times" index for all industrial shares was up by 4·6 points to 93·1, while the "Electrical Times" index for electrical shares rose rather less sharply to 87·3, an increase of 3·1 points. Both these figures are based on average prices during 1948



Commercial Information

CONTRACTS OPEN

HOME

Aug. 8.—Bury T.C. Supply and erection of Enfield suspension lighting systems in Transport Depot, George St., and in the Rochdale Rd. garage. Borough Engineer, Town Hall. Deposit £2 2s.

Aug. 8.—Coleraine. Electrical works at Coleraine Hospital for N. Ireland Hospitals Authority. Documents from W. and M. Given, Architects and Engineers, 1 Waterside. Deposit £2 2s.

Aug. 8.—Stepney B.C. Installation of power and lighting points in 124 dwellings in Cornwall St. area. Borough Engineer and Surveyor, Municipal Offices, 227-33 Commercial Rd., E.1. Deposit £5. (See July 17 issue.)

Aug. 8.—Waterford. Public Assistance Board invites tenders for installation of internal communication in County Hospital, Waterford, County Home and District Hospital, Dungarvan, and the Fever Hospital, Waterford. Edward R. Ryan, Consulting Engineer, 1 Montpellier Ter., Galway. Deposit £5 5s.

Aug. 8.—West Kesteven R.D.C. Electrical installation in five houses at Great Gonerby. J. Dean, Surveyor, Council Offices, 19 Watergate, Grantham.

Aug. 9.—Alnwick R.D.C. Electrical installation in 18 flats at Alnmouth. Applications by above date to Reavell and Cahill, architects, Lloyds Bank Chambers, Alnwick.

Aug. 9. — Ince-in-Makerfield U.D.C. Electrical installation in erection of 60 houses on Betersby St. site. Surveyor, R. Lewis. Town Hall. Deposit £1 1s.

Aug. 9.—Leeds. Electrical installation in erection of admission hospital and hostels at Stanley Royd Hospital, Wakefield, for Regional Hospital Board. Applications by above date to Board's secretary, Wm. A. Snee, Park Parade, Harrogate.

Aug. 9.—Peterborough. Lighting and power installations in 50 houses on Dogsthorpe estate. Applications by above date to F. J. Smith, City Engineer and Surveyor, Town Hall. Deposit £2 2s. (See July 31 issue.)

Aug. 9.—Worsley U.D.C. Electric wiring for power and light in 81 dwellings on Hill Top site, 274 dwellings on Mount Skip site and 28 on Boothstown site. Also supply of electric washboilers and cookers for same. These are separate contracts. H. Lomax, Clerk to Council, Town Hall, Walkden, Manchester.

Aug. 11.—Elland U.D.C. Electrical work in 14 houses in Thomas St. Engineer and Surveyor, Council Offices. Deposit £2 2s.

Aug. 11.—Kidsgrove U.D.C. Electrical installation in 128 houses and six bungalows in Lower Ash scheme. Architect, Town Hall. Deposit £2 2s.

Aug. 11.—Leeds. Supply of 60 side- and one top-entry totally enclosed 140 W sodium lanterns with control gear. Town Clerk, Room 57, Civic Hall. (See July 24 issue.)

Aug. 11.—Tyrone. Wiring and electrical installation at Clogher Old Persons Home. R. Parke, Secretary, Welfare Office, Omagh.

Aug. 13.—Bacup T.C. Electrical work in 24 flats on Huttock End No. 2 site. Borough Engineer, Municipal Offices. Deposit £2 2s.

Aug. 14.—Carrickfergus T.C. Electrical work in 400 dwellings on Victoria Rd. estate. Borough Surveyor, Town Hall. Deposit £2.

Aug. 15.—Cookstown. Complete electrical installation at fire station being built in Chapel St. H. B. Reid, Secretary to N. Ireland Fire Authority, Castle St., Lisburn. Deposit £2 2s.

Aug. 15.—Durham. Electrical installation in sundry police houses on Red Hills estate. G. R. Clayton, Architect to Police Authority, Court Lane.

Aug. 16.—Ceiriog (Denbigh) R.D.C. Electrical installation in (*a*) six houses at Penybont, and (*b*) four at Pandy. R. W. Aubrey, Surveyor, The Mount, Chirk. Deposit £1 1s.

Aug. 16.—Selkirk T.C. Electrical work in erection of two blocks of (18) houses on Bannerfield site. Office of Town Clerk, Municipal Buildings.

Aug. 18.—Manchester. Electrical installation at "Ellerslie," Suffolk Rd., Bowdon, Cheshire. City Architect, Town Hall. Deposit £1 1s. (See July 31 issue.)

Aug. 18.—Washington U.D.C. Electrical work in erection of 46 houses in Oxford Ave. Surveyor, Council Chambers.

Aug. 22.—Edinburgh. Electrical installation in primary school at Southhouse. City Architect, City Chambers, Edinburgh 1.

Aug. 23.—Stroud (Glos.) R.D.C. Wiring in houses in Tetbury St., Minchinhampton. Housing Manager, Council Offices.

Aug. 25.—Bury T.C. Electrical Installation at Fairfield Primary School. Borough Engineer, Town Hall. Deposit £2 2s.

Aug. 25.—Haltemprice U.D.C. Complete installation of street lighting in parts of Cottingham district, including concrete columns, lanterns, 85 W sodium lamps along 2·7 miles, and casteron columns, lanterns and 150 W tungsten lamps along 1·2 miles. Engineer and Surveyor, Anlaby House, Anlaby. Deposit £2 2s.

Aug. 30.—Ashton-in-Makerfield U.D.C. Supply of mobile tower unit for street lighting purposes. Surveyor, Town Hall.

Sept. 1.—West Riding. Renewal of electrical installation at "The Beeches," Tadcaster. Applications to County Architect, "Bishopgarth," Westfield Rd., Wakefield. Deposit £2 2s. (Advertised in this issue.)

Sept. 3.—Greenwich B.C. Tenders invited for electric street lighting schemes under Contract No. 1: removal of 367 h.p. gas columns and adaptation and re-erection of 233 columns, and adaptation *in situ* of 141 columns; and under Contract No. 2: provision of bracket arms, lanterns, control gear and wiring to 374 columns and 2 suspended lanterns. Borough Engineer and Surveyor, Town Hall, S.E.10. Deposit £2 2s. (See July 24 issue.)

Sept. 8.—Musselburgh. Erection of 15 lamp standards and installation of sodium lamps in Pinkie Rd. Burgh Surveyor, Municipal Offices, High Street.

Sept. 12.—Kendal T.C. Provision and installation of 72 mercury vapour lighting units and 7 fluorescent units, in Group A, including concrete columns and auxiliary equipment, and wiring along Windermere Rd. Borough Engineer and Surveyor, Municipal Offices, Lowther Street. (See July 24 issue.)

No date stated.—Midlothian. Electrical work in erection of 12 houses at Stowe. Documents from County Architect, 32 Palmerston Place, Edinburgh.

No date stated.—N. of Scotland H.E. Board. Supply and erection of approximately 13 miles of 33 kV double-circuit woodpole overhead lines in Killin district, Perthshire. Merz and McLellan, 39 Northumberland St., Edinburgh 3. Deposit £2 2s. (Advertised in this issue.)

No date stated—Tranent T.C. Electrical work in 9 houses in Ormiston Rd., 8 in Fowler St., 6 in Robertson Drive and 3 in Church St. Applications to R. M. Sorbie, Town Clerk, Council Chambers.

OVERSEAS

Details of items marked may be obtained on application to the Board of Trade, Horseguards Avenue, S.W.1, quoting reference.*

Aug. 14.—South Africa. Supply of two tropical model, dual diversity independent sideband, reduced carrier wireless receivers. Chairman, Union Tender and Supplies Board, 271 Visagie St. (P.O. Box 371), Pretoria. B.o.T. (Ref. CRE 26595/52).*

Sept. 1.—Uruguay. Tenders invited for supply of sundry materials for surgical use, including electric lamps, lamps for batteries of three elements, and batteries for lamps of three elements. Ministerio de Salud Publica, Seccion Adquisiciones, 3 er Piso, Avenida 18 de Julio No. 1892, Montevideo. B.o.T. (Ref. CRE 25867/52).*

Sept. 2.—Australia. Manufacture, supply, installation and testing of electrically driven centrifugal pumping plant comprising three pumping units, control equipment, cables, pipes, etc. Commissioner for Irrigation and Water Supply, William and Margaret Sts., Brisbane.

Sept. 2.—Uruguay. Tenders invited by Usinas Electricas y Telefonos del Estado for supply of 80,550 metres of lead-covered conductors to be used under normal tension of 220 V. B.o.T. (Ref. CRE 24852/52).*

Sept. 6.—Syria. Supply of considerable quantities of various telephone and telegraph cable and equipment for Directorate General, Posts, Telegraphs and Telephones, Damascus. B.o.T. (Ref. CRE 25246/52).*

Sept. 9.—South Africa. Supply and erection of circulating water pumps and pump-house equipment, and supply of circulating water valves for Bloemfontein's new power station. Consulting Engineers, Merz and McLellan (South Africa), 1419 Escom House, Rissik St., Johannesburg. Deposit £2 2s.

Sept. 11.—South Africa. Supply and erection of eight centrifugal water pumps with drive, electric motors, starters, valves and accessories for Municipality of Douglas. Tenders also invited for supply and erection of filtration plant for treating crude river water at rate of 8,000 g.p.m., with filters, dosing plant, electrical equipment, pumps, air compressors and accessories. Town Clerk, Douglas. Deposit £2 2s.

Sept. 11.—South Africa. Municipality of Reitz requires supply and erection of plant and equipment to convert existing d.c. system to 11 kV a.c. system. Contract No. RTS/HEP/52 includes switchgear and control equipment, transformers, replacement of d.c. appliances, etc. Town Clerk, P.O. Box 26, Reitz. Deposit £5 5s.

Sept. 25.—South Africa. Supply of 1,200 sets of speed indicator equipment and 24,000 ft electric cable for South Africa Railways. Chairman of Tender Board, P.O. Box 7784, Johannesburg. B.o.T. (Ref. CRE 25985/52).*

Nov. 4.—New Zealand. State H.E. Dept. invites tenders for manufacture and supply of 350 MVA 11 kV switchgear of duplicate busbar indoor metal-clad drawout type and accessories for New Plymouth substation. Copies of documents will be at N.Z. Government Offices in London.

Nov. 4.—New Zealand. Supply of eight 110 kV three-pole 1,000 A, and six 110 kV three-pole 600 A air break switches, and three 110 kV three-pole same with earthing switches; also set of spares, all for Roxburgh power station. Tenders to Secretary of Tenders Committee, State H.E. Dept., Wellington. Documents from N.Z. Government Offices in London.

Your Queries — Answered

"Maywick" brooders, makers of? S.B.—Mayes of Wickford, Ltd., 2 High St., Wickford, Essex. (23547)

"Toastmaster" toasters, agents for? J.E.—Frank V. Magrini, Ltd., 24 Royal College St., N.W.1. (23554)

Electric and magnetic controlled gearing for 1/100th h.p., makers of? D.E.—Try: James W. Carr and Co. Ltd., 7 Roseberry Ave., E.C.2; Croydon Eng. Co. Ltd., Commerce Way, Croydon; Electromagnets, Ltd., 1 Bond St., Birmingham; Parvalux, Ltd., Broom Rd., Parkstone, Dorset; Rapid Magnetting Machine, Ltd., Lombard Rd., Birmingham 12. (23562)

Motors, 1/50th h.p., 2,800 r.p.m., 230 V, 50 cycles, split phase, makers of? N.E.—Try: E.M.I. Eng. and Development, Ltd., Wells, Somerset; Croydon Eng. Co., Ltd., Commerce Way, Croydon. (23569)

"Eeco" and "Eeko" elements, makers of? T.E.—Electric Elements Co., Tokenhouse Yard, Bridlesmith Gate, Nottingham. (23574)

"Clyde" electric clocks, makers of? L.E.—British and Foreign Agencies, Colven St., Bridgeton, Glasgow. (23584)

"Beatty" washing machines, agents for? F.J.—Beatty Bros. (Tenbury), Ltd., Station Bldgs., Stamford New Rd., Altrincham, Ches. (23597)

The above are selected from questions we have answered this week. If you have a query, send it to us.

Answer Wanted

D.C. milliammeter (10 mA full scale) with 2 pointers (on one side), concentric giving 2 independent indications—makers of? H.H. (23604)

CONTRACTS PLACED

B.E.A. Two 135,000 lb./hr. boilers at Cowes, Daniel Adamson and Co. Ltd.; 2 generator transformers at Goldington, Hackbridge and Hewittic Electric Co. Ltd.; Coal handling plant at Drakelow, Mitchell Engineering Ltd.; 2 150,000 lb./hr. boilers at Northampton, Bennis Combustion Ltd.; 1 cooling tower at Meaford B, Davenport Engineering Co. Ltd.; same at Bold power station, Film Cooling Towers Ltd.; ash and dust handling plant at Ince, Babcock and Wilcox Ltd.; 3,300 V and 415 V switchgear at Skelton Grange, English Electric Co. Ltd.; 3 60,000 kW turbo-generators, condensing and feed heating plants at Stella North, C. A. Parsons and Co. Ltd., and low pressure piping equipment for Stella North, Aiton and Co. Ltd.; 4 60,000 kW turbo-generators, condensing and feed heating plants at Stella South, C. A. Parsons and Co. Ltd.; 1 cooling tower at Chadderton, Fred Mitchell and Son Ltd.; 90 MVA 132 kV oil-filled reactors at Carrington substation, Hackbridge and Hewittic Electric Co. Ltd.; 275 kV twin 0·4 sq. in. overhead line between Staythorpe and Elstree, British Insulated Callender's Construction Ltd.; and 132 kV overhead line between Llantarnam and Crumlin (Mon.), J. L. Eve Construction Co. Ltd.

TRADE NOTES

Agents Wanted. Canadian Armature Works, 6595 St. Urbain Street, Montreal, 14, are seeking agents in British and other export markets for their "Ray-Dian" electric glass heat panels for 110 V or 220 V working.

Branch Office. The Birmingham office of the Edison Swan Electric Co. Ltd. is now at Swan House, 10 Hospital Street, Birmingham, as we note elsewhere in this issue. Telephone remains, Central 6411.

Change of address. The removal of the headquarters of the Purchase Tax section of the Secretaries' Office of the Customs and Excise Department was due to take place this week to King's Beam House, Mark Lane, E.C.3. The telephone number (Man. 1515) remains unchanged.

E.W.F. T. Stanley Weston and Co. Ltd., 346 Sauchiehall Street, Glasgow C.2, have been elected a member of the Electrical Wholesalers' Federation.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Tuesday night)

	£ s. d.	New York price
COPPER, electrolytic	285 0 0	£280 0 0
LEAD, good soft pig (foreign)	131 0 0	128 0 0
" " " "English" quality ...	161 10 0	
Tin (99—99·75%) ... ...(Cash)	940½-941½	—
" (3 months)	941½-942½	—
ALUMINIUM, commercial purity (del.)	157 0 0	—
ZINC	130 0 0	118 0 0
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	55 0 0	—
Mild Steel Tape (0·04 in.)	39 15 0	—

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Air Conditioning and Engineering Ltd. Meeting of creditors will take place tomorrow (Fri.) at 26-28 Hallam St., Portland Place, W.1, at 12 noon.

Electrical Engineering and Advice Bureau Ltd., electrical contractors, Regent St., W.1. First and final dividends of 8·13d. in £ payable at office of Official Receiver, Inveresk House, 346 Strand, W.C.2., on July 31 or any subsequent day (except Sat.) between 11 a.m. and 2 p.m.

Voluntary Liquidation

Arpan Engineering Co., Ltd., Mortimer St., W.1, manufacturers of electrical equipment. At statutory meeting of creditors it was reported that at earlier meeting shareholders had passed necessary resolution for voluntary liquidation.

The company was incorporated in 1940, with nominal capital of £100, as manufacturers and suppliers of air-raid shelters. In 1945, business was converted to peace-time production of electric fires, lamp standards and other equipment. When 100 per cent. purchase tax was imposed on company's products in 1947, sales ceased with the cancellation of practically all orders on hand. Company then embarked on production of commercial drying oven. According to statement of affairs, liabilities to unsecured creditors amounted to £21,363. Assets of book value of £4,102 were estimated to produce £1,065 and were insufficient to extent of £2,328 to meet preferential claims of £3,393. Total deficiency as regard creditors amounted to £23,692.

Mr. David Morgan, accountant, of 100 Park St., Grosvenor Sq., W.1, was appointed liquidator, with committee of inspection.

Winding-Up

Horace Guest, Ltd., of Ampthill, Beds, electrical engineers. At first meeting of creditors Official Receiver reported that winding-up order was made on June 30.

The company was formed in April, 1949, with a nominal capital of £2,000, of which £600 had been issued. According to draft statement of affairs liabilities amounted to £826 against assets of £311. No resolution was passed and matter was left in hands of Official Receiver as liquidator.

BANKRUPTCY ACTS

Receiving Orders

Bristol. Graham A. Phipps, electrician trading at 51 Frampton Crescent, Fishponds. Date of order, July 23.

Great Grimsby. Kenneth G. Rudd radio and electrical contractor trading at 4 Commercial Rd., Louth. Date of receiving order, July 25.

Windsor. Kenneth J. Ward, trading at "Howard," Trusthorpe Rd., Sutton-on-Sea, Lincs., as electrical contractor. Date of receiving order, July 23.

Public Examinations

Nottingham. Kirkstall Radio and Electrical Service of Kirkstall Lodge, Edwinstowe. Public examination at County Court House, St. Peter's Gate, Nottingham, on Nov. 6 at 10 a.m. First meeting took place yesterday (Wed.).

Stoke-on-Trent. Douglas G. Edwards, electrical engineer, trading at 8 Blackfriars Rd., Newcastle-under-Lyme. Public examination at Town Hall, Hanley, Stoke, on Sept. 11 at 2.30 p.m.

Intended Dividends

Sheffield. Hubert L. Ruff, electrical engineer of 141 Abbeydale Rd., Sheffield. Last day for receiving proofs, Aug. 13. Trustee is A. L. Medcalf, Official Receiver, 55 Queen St., Sheffield.

BUSINESS PROSPECTS

HOME

Abingdon R.D.C. It has been proposed that 260 houses be erected on Sutton Courtenay site.

Andover T.C. Approval granted for erection of 38 houses near the Harroway.

Atherton (Lancs) U.D.C. Construction of 200 houses in first section of land north of the railway to go ahead.

Ballymena T.C. Erection approved of 198 houses at Demesne for N. Ireland Housing Trust.

Bedford T.C. Max Lock, Architect, 7 Victoria Sq., S.W.1, will probably be appointed to prepare plans for 156 houses on Eastcotts Rd. estate.

Boreham Wood. Fire and ambulance station estimated to cost £22,900 proposed for Elstree Drive.

Brighton T.C. It is proposed to build 97 dwellings and six shops in stage 1 of Hertford St. development area.

Buckfastleigh U.D.C. Application being made for permission to invite tenders for erection of 30 houses and eight flats on Tweenways site.

Chester. Tenders likely to be invited soon for erection of 11 shops with maisonettes at Blacon.

Croydon T.C. First stage of Langrave secondary school is estimated to cost £62,000. Also plans prepared for reconstruction and extension of factory and offices in Aurelia Rd. for Powers-Samas Accounting Machines, Ltd.

Consett U.D.C. New housing estate to be developed in Gloucester Rd. Council's Architect is J. J. Eltringham, Derwent St., Blackhill.

Croxley Green. Plans prepared for £37,050 extensions at Durrants secondary school.

Douglas (I.o.M.). Construction of new children's wing and twin operating theatre unit at Noble's Hospital. Hospital's Architect is W. T. Quayle.

Dover T.C. Tenders likely to be invited soon for erection of 42 houses on Buckland estate and block of 36 flats at Durham Hill.

Down. Construction of primary schools at Magheramayo, Cargary. W. H. M'Evoy, quantity surveyors, Ulster Bank Chambers, 73 May St., Belfast.

Dumbarton. Dean of Guild Court has approved plans for 234 houses at Bellsmuyre for Scottish Special Housing Association. Estimated cost, £353,400.

Durham. Plans in hand for provision of children's homes at Houghton, Tow Law, Bowburn and Peterlee, and three residential nursery schools. Also R.D.C. is seeking loan sanction for £103,006 for erection of 60 houses at Sherburn and 28 at Witton Gilbert.

East Retford T.C. Erection of 50 dwellings on Hallcroft estate. Vallance and Westwick, White Hart Chambers, Mansfield are council's architects.

Farnborough U.D.C. Erection of block of shops and flats on Minley Rd. estate. L. C. Jenkins, Engineer and Surveyor, Town Hall.

Folkestone T.C. Construction of 78 houses on Creteway Down site. Borough Engineer, Municipal Offices, West Terrace.

Goole T.C. Scheme for development of Ilkeston Ave. site at estimated cost of £107,772 has been submitted for approval.

Hampstead. Scheme approved for development of Finchley Rd. No. 1 (West) site. This includes construction of 84 flats, 254 maisonettes in 17 blocks and 12 houses. Cost is estimated at £841,100.

Horsham R.D.C. It is proposed to carry out electrical installation in various council houses at cost of nearly £760.

Kincardine. Plans approved for 50 houses near Portlethen Station site.

Lambeth. Scheme prepared for development of Loughborough Rd. site. It includes 21 blocks of (737) maisonettes, four blocks of (230) flats, 62 houses, and 10 shops. Estimated cost is £2,374,600.

Llandovery T.C. Approval received for erection of 58 houses at Caefelincean.

Lleyn (Caernarvon) R.D.C. Erection of 24 houses at Nevin. Architect is J. Egbert Griffiths, 1 Bank Place, Portmadoc.

London. Tenders to be invited for manufacture and supply of a further 100 lifts for installation in blocks of flats on C.C.'s estates early in 1954. Contractual arrangements have been made concerning 100 lifts to be installed by next June and 100 more by end of 1953.

Monmouth T.C. It has been proposed to erect a further 85 houses during next three years.

Newcastle-on-Tyne. Erection of maternity and child welfare section on Blakelaw estate. City Architect, 18 Cloth Market.

Northumberland. Building programme for 1953-54 includes two schools at Whitley Bay costing £134,640 each, and completion of Morpeth primary school at £30,240. There is also a reserve list of two schools.

Northamptonshire. It is proposed to erect grammar school at Corby (£198,790), and extensions at Towcester county school (£20,124).

Old Fletton (Hunts) U.D.C. Erection of 22 and 20 houses at Stanground. Ruddle and Wilkinson, architects, Long Causeway Chambers, Peterborough.

Penzance T.C. Schemes approved for erection of 45 dwellings at Navy Inn Court, Newlyn, and flats at St. Clare St.

Ramsbottom U.D.C. Revised plans approved for Tagg Wood site providing for 92 houses and 12 flats.

Romsey T.C. Tenders being invited for site works in preparation for erection of 57 dwellings at Priestlands. Borough Engineer and Surveyor is John Davies.

Renfrew. Approval granted for erection of 228 houses at Lochwinnoch, Ralston, Thornliebank, Kilmacolm, Newton Kearns, Kilbarchan and Eaglesham.

Ruthin T.C. Erection of 82 houses on Haulfryn estate. B. Stephenson Stanton, Town Clerk, Town Hall.

Spalding U.D.C. New estate approved provisionally from Cowbitt Rd. to Clay Lake. It will include 250 houses.

Stevenage. Junior school to be built at Broadwater Shephall at estimated cost of £57,380.

Tipton T.C. Erection of 66 houses on Park Lane West estate. Housing Architect, Municipal Buildings.

Tunbridge Wells T.C. Construction of 44 houses and 32 houses under contracts 3 and 4 on Sherwood estate. H. P. Bishop, Borough Surveyor, Town Hall.

Wallingford T.C. Erection of 34 dwellings in district. C. R.

Business Prospects—contd.

Lawless, Borough Surveyor, Municipal Offices, High Street.

West Bromwich T.C. Scheme approved for installation of electrical hot-water heaters in schools within the borough at an estimated cost of £4,000.

West Riding. C.C. recommended to approve renewal of electrical installation at Elland, Ilkley, and Mexborough grammar schools. Costs estimated at £3,000, £2,100 and £4,250 resp.

OVERSEAS

Canada. Pelton-Canada of 206 Sherbourne St., Toronto, wishes to secure representation of U.K. manufacturers of commercial and industrial refrigeration.

Ecuador. Table model radio receivers for a.c. 110 V, 60 c/s with at least six valves and three wave bands, covering 11 to 580 metres are among list of goods which Iguacio Rubio Ortega, Territorio del Azuay-Canar y Loja, Carrera Bolivar No. 208, Cuenca, wishes to import.

Indonesia. Mr. Jap Kim Loan of 96 Keplekan st., Pekalongan, Java, wishes to contact U.K. manufacturers of (among other items) radios and radio gramophones, office machines and refrigerators.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Crustex. 703,741. Class. 9 Electrical apparatus for the prevention and removal of incrustations and scale in liquid containers by the action of supersonic vibrations. H. R. Hilfiker and Co., Weinbergstrasse 11, Zurich, Switzerland.

Invicta. 704,917. Class 7. Machine tools and shaping machines. B. Elliott and Co. Ltd., Victoria Works, Victoria Rd., Willesden, N.W.10.

Karma. 107,583. Class 9. Electrical resistance wire made of nickel-chromium alloy. Driver-Harris Company, corner of Middlesex and Second Streets, City of Harrison, New Jersey, U.S.A.

King's Messenger. 705,530. Class 9. Television apparatus. Avimo Ltd., Herbert St., Rowbarton, Taunton, Somerset.

Microdual. 705,004. Class 9. Electrical apparatus and component parts of wireless receivers. B. Zucker, 138a Cromwell Rd., S.W.7.

Notek, in triangular design. 704,482. Class 11. Electric torches, lamps for motor vehicles, reflectors, etc., Notek Electric Co., Ltd., 23 London Rd., Bromley, Kent.

Polyflux, 706,452 and **Polybond,** 706,413. Class 9. Aerials for wireless telegraphy and television; electric flexibles, insulated wires, cable and conductors. The Concordia Electric Wire and Cable Co. Ltd., Trent Mills, Derwent St., Long Eaton, nr. Nottingham.

Procene. 706,283. Class 6. Cored solder, the solder predominating. H. J. Enthoven and Sons Ltd., Enthoven House, 89 Upper Thames St., London E.C.4.

Psychostrobe. 706,109. Class 9. Electrical apparatus for use in physical research. May Macmunn, "Wynford", Heron Hill, Belvedere, Kent.

Qualbat. 706,989. Class 9. Electrical instruments and apparatus. Marshall Batteries, 44 South End, Croydon, Surrey.

R. & M. B706,967. Class 6. Pulleys containing ball or roller bearings; B706,970. Balls for ball bearings, and pulleys. Ransome and Marles Bearing Co., Ltd., Stanley Works, Newark-on-Trent.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

Cherry's (Northern) Ltd., 10, Norham Rd., Whitley Bay. Dealers in and manufacturers of full-scale and model mechanical engineering goods, sports and games equipment, non-mechanical models and toys, radio, electrical, pyrotechnical and other hardware goods, etc. Cap.: £100. Dirs.: R. du Pille and S. F. du Pille.

Clorius Heat Meters (England) Ltd., Murray House, 3-5, Vandon St., Buckingham Gate, S.W.1. Manufacturers of and dealers in heat meters; general engineers, etc. Cap.: £4,000. Permt. dirs.: F. E. Jennings and N. G. Leland.

Dialled Despatches, Ltd. Manufacturers of and dealers in pneumatic tube despatch systems, mechanical and electrical apparatus for the conveyance and handling of goods, and transmission of messages, etc. Cap.: £100. Dirs.: to be appointed by subs. Subs.: H. B. Ringrose and R. D. Fox (solrs), 2, Clements Inn, W.C.2.

Drywell Products Ltd. Mechanical, electrical and general engineers; manufacturers of and dealers in drying plant, etc. Cap.: £100. Permt. dirs.: Leah Losofsky, 20, Anson Rd., N.W.2 and L. Heiliger, 25, Blomfield Rd., W.9.

Richard Eden and Co., Ltd. 415, Green Lanes, Harringay, N.4. Mail order, retail and wholesale dealers in and manufacturers of radio, wireless, radar and television sets and parts, etc. Cap.: £100. Permt. dirs.: R. Eden and Catherine Vass.

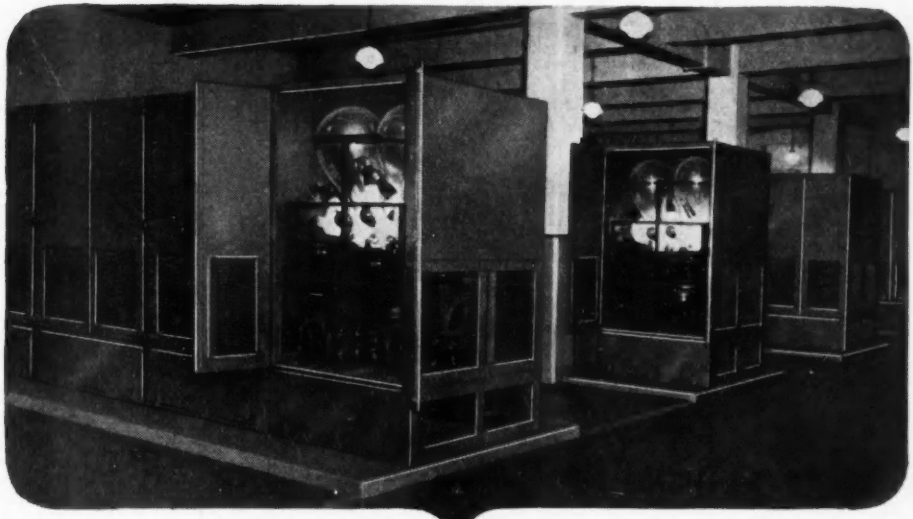
Grimmett, Oliver and Co., Ltd., 123, Thames Side, Staines, Middlesex. Manufacturers of and dealers in electric news-vending machines, signs and appliances, etc. Cap.: £100. Dirs.: T. H. Grimmett and Violet A. Grimmett and J. P. Oliver.

G. F. Hardwick (Lincoln) Ltd., 173, Burton Rd., Lincoln. Electrical engineers, dealers in dynamos, motors, etc. Cap.: £5,000. Dirs.: G. F. Hardwick (permt.) and Mrs. P. Hardwick.

J. V. Radio and Television Ltd., 25, William St., Plymouth. Cap.: £6,000. Dirs.: H. Jones C. J. C. Veale, and A. P. Parish.

Radio Rentals (Sales with Service) Ltd., 17, Bentinck St., W.1. To acquire whole or not less than 90% of issued shares of Vidio Rentals, Ltd., and with a view thereto to enter into an agreement with Radio Rentals, Ltd., Prudential Assurance Co., Ltd., and Rentertainments (London), Ltd. Cap.: £150,000. Dirs.: H. F. Hunt, P. Perring-Thoms, A. D. Smith and W. P. C. Welch.

Yorkshire Rewinds Ltd., 32 Norfolk Lane, Sheffield 1. Manufacturers of and dealers in armatures, magnetos, dynamos, etc. Cap.: £500. Dir.: A. T. Walker.



Hewittic Rectifiers

PUMPLESS – AIR COOLED – UP TO ANY CAPACITY

Simple and reliable, robust, compact; backed by nearly 50 years' experience, Hewittic Rectifiers have proved to be the ideal converting plant for all forms of D.C. load — traction, electro-chemical, light and power, industrial, battery charging, cinema arcs, etc. Send for further details.

OVER 1¼ MILLION KW. IN WORLD WIDE SERVICE

The illustration shows Hewittic Rectifiers in traction service in Canada (British Columbia Electric Co.). Each bank has a capacity of 1,500 kW. with high overload rating for heavy traction service. The total capacity of Hewittic Rectifiers on this system is approximately 30,000 kW.

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone : Walton-on-Thames 760 (8 lines) *Telegrams : "Electric, Walton-on-Thames"*

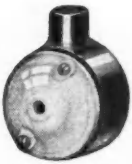
"A job to be proud of!"

What satisfaction in a job well done. It is *inevitable* with Metallic quality and consistent accuracy.

Screwed and Socketed Conduit Thread.

Sunk-type Switch Iron Cover.

Sunk-type Plug Fitting Iron Cover.



Direct Mounting Flat-type Ceiling Rose.

It always pays to SPECIFY METALLIC

CONDUIT TUBE & FITTINGS

A TI COMPANY

THE METALLIC SEAMLESS TUBE Co. Ltd., Ludgate Hill, BIRMINGHAM 3. Tel. CEN 7167

Also at London, Newcastle-on-Tyne, Leeds, Swansea and Glasgow

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED . FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 42s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

COUNTY COUNCIL OF THE WEST RIDING OF YORKSHIRE

Health Committee

TENDERS are invited for the RENEWAL OF THE ELECTRICAL INSTALLATION at The Beeches, Tadcaster.

Specification with plan, together with conditions of tender, may be obtained, on or after August 13, 1952, on application to the County Architect, "Bishopgarth," Westfield Road, Wakefield, on payment of a deposit of £2 2s. which will be returned on receipt of a bona-fide tender. Cheques must be made payable to the "West Riding Treasurer" and crossed "& Co."

Sealed tenders must be addressed to me, the undersigned, and received at Room 4, County Hall, Wakefield, not later than 10 a.m. on Monday, September 1, 1952.

BERNARD KENYON,
Clerk of the County Council.

July, 1952. (A 547)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

33 kV OVERHEAD LINES

TENDERS are invited for the SUPPLY, DELIVERY AND ERECTION of approximately 13 miles of 33 kV, double circuit, wood pole, overhead lines in the Killin district, Perthshire.

Copies of the tender document may be obtained on application to the Engineers, Messrs. Merz and McLellan, 39 Northumberland Street, Edinburgh 3. Applications should be accompanied by a cheque for £2 2s. (returnable).

The Board do not bind themselves to accept the lowest or any tender.

W. D. D. FENTON,
Secretary.

16 Rothesay Terrace,
Edinburgh 3.
July 30, 1952. (A 548)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

GENERAL ASSISTANT ENGINEER (Protection) required for Liverpool Region, Technical Department. Salary, £481 to £619, N.J.B. Class "AX," Grade 8. Superannuable.

Applicants should have passed the Higher National Certificate in Electrical Engineering and have practical experience in the testing of e.h.v. switchgear installations, site testing of relay and control circuits or relay testing and adjusting in manufacturers works.

Application forms may be obtained from the Divisional Secretary, Beaconsfield Road, Woolton, Liverpool. Closing date, August 23, 1952. (A 563)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER required at Ocker Hill Generating Station, Staffs. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade "F9", commencing at £587 per annum.

Ordinary National Certificate in mechanical engineering or equivalent qualification required, together with sound technical training and practical experience in power station operation.

Application forms available from the Establishments Officer 53, Wake Green Road, Moseley, Birmingham 13, to be returned completed by August 22, 1952.

F. W. LAWTON,
Divisional Controller.
(A 538)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

STATION SHIFT CONTROL ENGINEERS required at Nechells "A" Power Station. N.J.B. service conditions, superannuable appointments, salary within Schedule A, Grade "F.10," commencing at £557 per annum. The station is temporarily graded Class "G."

Higher National Certificate in Electrical Engineering or equivalent qualifications desirable; suitable applicants with Ordinary Certificate in Electrical Engineering will be considered. Practical experience in the control and operation of steam generating plant and main switchgear required.

Application forms available from Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, to be returned by August 22, 1952.

F. W. LAWTON,
Divisional Controller.
(A 566)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

STATION SHIFT CONTROL ENGINEER required for the Bromborough Power Station, Cheshire. Salary, £621 to £648 per annum, Class "H," Grade 10, N.J.B.

Applicants must have had experience in the Control Room of a modern power station and possess the Higher National Certificate in Electrical Engineering or equivalent qualifications.

The appointment is superannuable and subject to medical examination.

Forms of application may be obtained from the Divisional Secretary, Beaconsfield Road, Woolton, Liverpool. Closing date August 20, 1952.

W. A. GALLON,
Divisional Controller.
(A 562)

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF FIRST ASSISTANT DISTRICT ENGINEER

Mains Department—Penrith District

DUTIES will be to assist the District Engineer in the control, construction, operation and maintenance of the H.V. and M.V. networks throughout the District.

Salary scale, £721 to £758 p.a. Grade D.4. N.J.B. conditions.

Applications to Sub-Area Manager, No. 6 Sub-Area, the North Western Electricity Board, Castle Green, Kendal, by August 16, 1952. (A 550)

METROPOLITAN WATER BOARD

APPLICATIONS are invited for the undermentioned positions on the permanent pensionable staff. Maximum age 45 years.

It is a condition of appointments (A) and (B) that the selected candidates shall be and continue to be subscribing corporate members of the Institution of Electrical Engineers.

(A) ASSISTANT ELECTRICAL ENGINEER. Salary scale £1,184 p.a. rising by three annual increments to £1,341 p.a.

The person appointed will be responsible to the Board's Mechanical Engineer for the design, lay-out, installation and operation of the whole of the Board's electrical equipment, which includes high-tension sub-stations; high-tension motors, generators and control gear up to 3,000 h.p.; low-tension motors, generators and control gear. Housing accommodation may be available. (Reference "A" ET.)

(B) ASSISTANT ENGINEER (ELECTRICAL). Salary scale £830 p.a. rising by two annual increments to £884 p.a.

Applicants must have had experience in the design, arrangement, specifying and the assessment of tenders for high-tension sub-stations; high-tension motors, generators and control gear up to 3,000 h.p.; low-tension motors, generators and control gear; and associated wiring and cable work. Housing accommodation may be available. (Reference "B" ET.)

(C) DEPUTY PUMPING STATION ENGINEER at the Board's Ashford Common Pumping Station, Middlesex. Salary scale £572 p.a. rising by three annual increments to £637 p.a.

Applicants must have had a sound technical training and practical experience in the control, operation and maintenance of high-tension sub-stations, high-tension and low-tension motors and switchgear, large diesel-driven alternator sets, automatic and remote control gear, cables and wiring, and also in the control of men.

A modern three-bedroomed house is provided at an inclusive rent of £40 per annum. (Reference "C" ET.)

Particulars and a form of application may be obtained from the undersigned on receipt of a stamped addressed foolscap envelope quoting the appropriate reference.

W. S. CHEVALIER,
Clerk of the Board.

Offices of the Board,
New River Head,
Rosebery Avenue,
London E.C.1. (A 533)

CENTRAL ELECTRICITY BOARD FEDERATION OF MALAYA

ASSISTANT POWER STATION SUPERINTENDENT required by the Central Electricity Board, Federation of Malaya. Option of appointment either (a) on agreement for three years in the first instance leading, subject to satisfactory service, to an offer of permanent employment on the pensionable establishment, with opportunity of terminating appointment at the end of the first year's service if so desired; or (b) on contract for three years with a gratuity on satisfactory completion of final service at the rate of £70 for each completed period of three months' service. Salary (including allowances) payable in local currency equivalent at present Government rate of exchange to £1,799 rising to £1,988 a year. Additional allowance payable to married men according to dependants. Free passages. Liberal leave on full salary. Candidates must have wide experience of station maintenance and operation and preferably have held a similar position in a steam power station of not less than 80 MW capacity or as a charge engineer for at least five years in a station of not less than 120 MW capacity.

Apply at once by letter, stating age, full names in block letters, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4 Millbank, London S.W.1, quoting on letter M.28769.B. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. (A 537)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

THIRD ASSISTANT ENGINEER required in the System Operation Department at Divisional Headquarters. N.J.B. service conditions, superannuable appointment, salary within Schedule C, Grade 5, Class "AX," £629 to £765 per annum, rising ultimately to Grade 5, Class "EX." Grad. I.E.E. or equivalent essential, together with grid control centre and power station experience. Knowledge of power system load flow and short circuit calculations an advantage.

Application forms are obtainable from Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, and should be returned by August 22, 1952.

F. W. LAWTON,
Divisional Controller.
(A 564)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

STATION SHIFT CONTROL ENGINEER required at Wolverhampton Generating Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade "E.10," commencing at £535 per annum, plus £25 per annum System Control Duties.

Higher National Certificate in electrical engineering or equivalent qualifications required, together with sound technical training and practical experience in the control and operation of steam generating plant and main switchgear.

Application forms available from Establishments Officer, 53 Wake Green Road, Moseley, Birmingham 13, to be returned by August 22, 1952.

F. W. LAWTON,
Divisional Controller.
(A 565)

BRITISH ELECTRICITY AUTHORITY

North Western Division

STATION SUPERINTENDENT required for the new Carrington Power Station, near Manchester (ultimate capacity 240 MW). Applicants must have had experience in the management of a large modern steam power station, preferably with large P.F. boilers. Appreciation of modern concepts of administration, financial control and employee relations, including welfare, training, and joint consultation, is desirable. Salary £1,133 to £1,184 (N.J.B. G.1).

Apply, quoting vacancy No. 765, to the Establishments Officer, British Electricity House, 825 Wilmslow Road, Manchester 20, before August 30, 1952. (A 539)

SOUTH WEST SCOTLAND ELECTRICITY BOARD

Glasgow Sub-Area

APPOINTMENT OF SENIOR ASSISTANT ENGINEER (PLANNING AND DEVELOPMENT)

APPLICATIONS are invited for the position of Senior Assistant Engineer (Planning and Development) on the staff of the Sub-Area.

Applicants should have wide experience in the design and layout of large underground distribution systems at pressures up to and including 33 kV, in a densely loaded industrial and residential area. A knowledge of the principles of modern protective equipment and their application is necessary. Experience in the calculation of fault levels, the preparation of load flow diagrams, load research and sub-station design is also essential.

Preference will be given to candidates holding Corporate Membership of the Institution of Electrical Engineers or equivalent qualification.

The conditions of employment will be those of the Agreement of the National Joint Board for the Electricity Supply Industry, and the salary for the post will be in accordance with the Schedules to that Agreement, viz. Class "K," Grade 4, £1,068 to £1,115 per annum.

The appointment will be superannuable under the British Electricity Authority and Area Boards' Superannuation Scheme.

The successful candidate will require to reside within reasonable distance of the Sub-Area Headquarters.

Applications should be made on the official form, which may be obtained from the undersigned, and which should be completed and returned not later than August 30, 1952.

J. CAIRNS,
Secretary.

75 Waterloo Street,
Glasgow C.2. (A 567)

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

ASSISTANT SHIFT CHARGE ENGINEER at Croydon "B" Power Station. Applicants should have had suitable technical training together with experience in the operation of modern high-pressure power station plant. Preference will be given to those with P.F. experience. N.J.B. conditions of service, Class "J," Grade 9, £733 19s. p.a. inc. London Allowance. Applications on forms obtainable from Station Superintendent, Croydon "B" Power Station, Beddington Farm Lane, Purley Way, Croydon, Surrey, to be received by him not later than August 18, 1952. (A 532)

BRITISH ELECTRICITY AUTHORITY

North Western Division

VACANCY No. 768—SHIFT CHARGE ENGINEER at Whitehaven Generating Station. Salary £473 to £518 (N.J.B. A.7). Apply to Establishments Officer, British Electricity House, 825 Wilmslow Road, Manchester 20, before August 16. (A 535)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited from suitably qualified engineers for the following positions in this Division:

BOILER HOUSE SHIFT CHARGE ENGINEER
North Wilford Power Station, Nottingham
Vacancy No. 72/52

Applicants should have had a sound technical training, a good general engineering experience and a knowledge of the control and operation of large pulverised fuel boilers and associated equipment. Preference will be given to candidates who are in possession of technical qualifications admitting to Corporate Membership of a recognised professional institution.

The salary will be in accordance with Class "K," Grade 9 (£741 to £771 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, August 18, 1952.

GENERAL ASSISTANT ENGINEERS (PROTECTION)
Technical Department, Divisional H.Q.
Vacancy No. 73/52

Applicants should have the minimum technical qualification of Higher National Certificate in Electrical Engineering. Preference will be given to candidates who have completed a recognised post-graduate apprenticeship, and experience of high-voltage switchgear and protective gear will be an advantage.

Successful candidates will be required to reside in or near Nottingham.

The salary will be within Class "AX/DX," Grade 8 (£481 to £674 per annum) of Schedule "C" of the National Joint Board Agreement.

Closing date for receipt of applications, August 25, 1952.

The above positions are pensionable within the provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Application forms, which may be obtained from the Divisional Establishments Officer, British Electricity Authority, Barker Gate, Nottingham, should be submitted to the undersigned at the same address. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.
(A 549)

BRITISH ELECTRICITY AUTHORITY

South Western Division

GENERAL ASSISTANT ENGINEER required in the Telecommunications Section of the Technical Department at Divisional Headquarters, Bristol.

Superannuation scheme. Salary, N.J.B., Class "AX/DX," Grade 8, £481-£619/£661-£674.

Successful candidate will be required to work on telephone and supervisory equipment. Essential qualifications, Grad.I.E.E. and/or C. & G. Final Group Course Certificate.

Apply by August 16, 1952, stating age, qualifications, experience, present appointment and salary, to R. C. Barrett, Divisional Secretary, 26 Oakfield Road, Bristol 8. (A 534)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

North Caledonia Area

ASSISTANT DISTRICT ENGINEER required for Fraserburgh and district, Aberdeenshire. Salary and conditions of service in accordance with N.J.B. F/9 or 11 depending on experience and qualifications. Superannuation scheme applicable. Applications, giving full particulars of education, training and experience, to the Area Manager, West Villa, South Street, Elgin. (A 536)

GOVERNMENT OF KUWAIT

DIESEL POWER STATION SUPERINTENDENT

APPLICATIONS are invited for an appointment as Diesel Power Station Superintendent with the Government of Kuwait, Persian Gulf. The minimum technical qualification is the Higher National Certificate in Technical Engineering or its equivalent. Applicants, aged between 30 and 35 years, should have had good experience in diesel generating stations, in an administrative position, and be capable of supervising maintenance and operating the station at the highest possible efficiency. Applicants should have some electrical knowledge, and experience of steam power plant would be advantageous, as at a later date, the steam power station is to be commissioned and, if suitable, a transfer could be arranged. The salary offered is up to £1,650, according to experience. Free furnished quarters and medical attention are provided. The first year will be probationary and home leave will be granted at the end of two years' service. Married accommodation cannot be promised during the first year of service.—Applications, in writing, giving full particulars of training, qualifications and experience, should be addressed, in the first instance, to the Secretary, Ewbank and Partners Ltd., Engineering Consultants, 10/11 Grosvenor Place, London S.W.1. (A 519)

AMBITIOUS, ENERGETIC MAN required to take charge of test and inspection in an expanding company manufacturing electronic equipment. Within easy access of London. Must possess technical qualifications at least to Higher National Certificate standard and have sound knowledge of both electronic and mechanical engineering. Salary will be in accordance with the responsible nature of the post. House may be available later for suitable applicant.—Box No. 1921, Electrical Times. (A 557)

APPLICATIONS are invited by the English Electric Co., Ltd., Stafford, from YOUNG MEN having at least Higher National Certificate and some engineering experience in the DESIGN OF POWER TRANSFORMERS. Previous experience of this class of work is desirable but not essential.—Please write, stating age, qualifications and experience, quoting reference 225G, to Central Personnel Services, English Electric Co., Ltd., 24-30 Gillingham Street, London, S.W.1. (A 552)

BRITISH ELECTRICITY AUTHORITY have vacancies in the following superannuable posts at Headquarters in London.

SECOND ASSISTANT ENGINEER (switchgear specifications). Qualifications not below A.M.I.E.E. standard, should have works and site experience on layout, specification and operation of h.v. switchgear and associated equipment. Salary N.J.B., Grade 3, £814-£1,184, including London allowance. Quote reference AE/270.

SECOND ASSISTANT ENGINEER (grit arresting plant) to carry out technical investigations into the design features and performance of all types of grit arresting equipment for power station boiler plant, prepare specifications and to appraise tenders for such equipment. Qualifications not below I.Mech.E. or I.E.E. standard, together with recent experience in the design department of a manufacturer of grit arresting equipment (preferably electrostatic) for power station boiler plant. Salary N.J.B., Grade 3, £814-£1,184, including London allowance. Quote reference AE/271.

SECOND AND THIRD ASSISTANT ENGINEER (circuit breakers) with experience in design and construction of e.h.v. circuit breakers with preferably some experience of short circuit testing. Qualifications not below A.M.I.E.E. standard are essential. Salary N.J.B., Grade 3, £814-£1,184, Grade 4, £732-£954, including London allowance. Quote reference AE/272.

SENIOR ASSISTANT ENGINEER (combustion). Duties include the organisation of full-scale investigations concerned with external boiler fouling and the behaviour of dust carried by chimney gases. Candidates should hold a science or engineering degree or the equivalent, and have practical experience of combustion problems. Salary N.J.B. Grade 1, £975-£1,353, including London allowance. Quote reference AE/273.

SENIOR ASSISTANT ENGINEER (Chemist). Duties include work on the technical aspects of pollution of water-ways of all kinds and the treatment of natural waters for the prevention of slimes and deposits in heat-exchangers. Candidates should hold an honours degree in chemistry or a degree with chemistry as a principal subject. Experience in handling pollution problems will be an advantage. Salary N.J.B. Grade 1, £975-£1,353 including London Allowance. Quote reference AE/274.

Applications, which will be acknowledged, should be made on forms obtainable from D. Moffat, Director of Establishments, British Electricity House, Gt. Portland Street, London, W.1, by August 25, 1952. (A 561)

BRITISH ELECTRICITY AUTHORITY require SENIOR DRAUGHTSMEN and DRAUGHTSMEN at Headquarters in London with experience in reinforced concrete design and detail. Salary N.J.B., Grade 5, £574-£684 (for senior post), and Grade 6, £438-£574, including London allowance. Pension scheme. One Saturday in four on duty.

Applications, which will be acknowledged, should be made on forms obtainable from D. Moffat, Director of Establishments, British Electricity House, Gt. Portland Street, W.1, by August 25, 1952. Quote reference AE/277. (A 560)

BRITISH ELECTRICITY AUTHORITY, Southern Division, invite applications for the position of SECOND ASSISTANT STATION CHEMIST, at Earley Generating Station, Reading. Applicants should have had practical experience of fuel, water and oil testing, and a knowledge of boiler chemistry for high steam pressures and temperatures will be an advantage. Preference given to candidates with H.N.C. in chemistry or equivalent qualifications. Salary N.J.B., Class "G," Grade 11, £553 to £576.

Application forms, obtainable from P. D. A. Oliver, Divisional Secretary, British Electricity House, 111 High Street, Portsmouth, must be returned by August 20, 1952. (A 541)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

DRAUGHTSMAN required with experience in detail and production drawings of fluorescent and tungsten lighting fittings, Strand area, five-day week, pension scheme.—Apply in writing stating age, experience and salary required, to Personnel Manager, Ekco-Ensign Electric, Ltd., 45 Essex Street, London W.C.2. (A 540)

DRAUGHTSMAN used to boiler plant and industrial pipe installations of all classes, able to take own dimensions at site. State age, experience and salary required. Pension scheme.—The Brightside Foundry and Engineering Co., Ltd., 17 Summer Row, Birmingham 3. (A 471)

ELECTRICAL ENGINEER DRAUGHTSMAN required with experience in the design and installation of power and lighting schemes, distribution and control diagrams, etc. Excellent prospects for suitable men offered by Tees-side firm.—Apply, giving full particulars, to Employment Exchange, Stockton-on-Tees. (A 543)

ENGLISH ELECTRIC CO., LTD., have vacancies for JUNIOR PRODUCTION ENGINEERS at their Stafford works. These positions call for initiative and ability, with the Ordinary National Certificate in mechanical production engineering as minimum qualification. The work is concerned with the production, development methods, processes and works layout entailed in the manufacture of high-voltage switchgear to batch and customers' orders. Experience of switchgear is not essential.—Write, giving full details and quoting reference "English Electric 903D," to Westminster Employment Exchange, Chadwick Street, London S.W.1. (A 553)

EWBANK AND PARTNERS LTD. have the following vacancies for Engineers in their London office:

(a) QUALIFIED CONTRACTS ENGINEERS, who have had a good mechanical training and experience in the design and operation of large steam power plants and associated equipment. Applicants must be competent to prepare specifications, estimates and contract documents, and to take charge of large engineering contracts from the design stage through to the completion of the work at site. Some electrical experience will be an advantage.

(b) FIRST ASSISTANT TECHNICAL ENGINEER for the Investigation and Testing Department. Applicants must possess an Honours Degree in Mechanical Engineering or Physics and have had experience in the operation and testing of large power plants. Preference will be given to engineers who have had experience in the project design of plants for the supply of power, steam and other services.

(c) SECOND ASSISTANT TECHNICAL ENGINEER, who must possess an Honours Degree in Mechanical Engineering or Physics. Preference will be given to engineers who have had experience in instrumentation and automatic control and technology as applied to industry and power plants. A knowledge of power plant operating, testing or design is also required.—Applications, giving age and full details of experience and qualifications, should be addressed to the Secretary, Ewbank and Partners Ltd., Engineering Consultants, 10-11 Grosvenor Place, London S.W.1. (A 522)

EXPERIENCED SENIOR TECHNICAL SALES ENGINEER required to take over considerable turn-over in London and the Home Counties for M.V. switchgear including full range heavy duty H.R.C. fuse switches to 800 amps. distribution boards, all types M.V. switchboards, substation switchboards, full range rewireable industrial and domestic switch and fusegear. Good salary, commission and expenses, excellent prospects for keen man to work on own initiative directly responsible to Managing Director. Send full particulars, which will be treated in complete confidence.—G. P. Dennis Ltd., Fleming Road, Speke, Liverpool. (A 530)

FITTER (MECHANICAL) required. Preference will be given to applicant who has had previous experience on boiler and turbine instruments, including CO_2 and oxygen recorder, multi-point thermometers, etc.

Rate of pay, 3s. 4½d. per hour. N.J.I.C. wages and conditions.

Apply to Station Superintendent, British Electricity Authority, South Western Division, Castle Meads Generating Station, Gloucester. (A 554)

IMPERIAL CHEMICAL INDUSTRIES LIMITED invite applications for the following vacancies:—

SENIOR ASSISTANT ENGINEER (GENERATION) P/1. Applications are invited for the position of additional Senior Assistant Engineer in the Generation Section of the Company's Power Department, Runcorn, Cheshire. The duties are to assist, under the direction of the Generation Section Manager in the headquarters of the department, with the operation and maintenance of the Division's power stations, which have an installed capacity of more than 1,000 kW, and with the design of extensions thereto. Applicants, who should be between the ages of 30 and 38 years, and should hold a Degree in Mechanical or Electrical Engineering, must have had a sound mechanical engineering training and should have had considerable experience of the operation and maintenance of large modern high-pressure steam power stations. In addition, they should have had some experience of the preparation of designs and specifications for new plant and of investigations and tests in connection therewith, while Corporate Membership of either the Institution of Mechanical Engineers or the Institution of Electrical Engineers is also desirable. The commencing salary will not be less than that given in N.J.B. Schedule "C," for Grade 1, Class "CX," headquarters staff. The selected candidate will be required to pass a medical examination and to join the Company's pension fund.

SENIOR ASSISTANT ENGINEER (MECHANICAL) P/2. Applications are invited for the position of additional Senior Assistant Engineer in the Mechanical Section of the Company's Power Department, Runcorn, Cheshire. The duties are to assist, under the direction of the Mechanical Section Manager in the headquarters of the Department, with the maintenance of the mechanical equipment of the Division's power stations, which have an installed capacity of more than 100,000 kW, and with the design of extensions thereto. Applicants, who should be between the ages of 30 and 38 years, and should hold a Degree in Mechanical Engineering, must have had a sound mechanical engineering training and should have had considerable experience of the maintenance and design of the mechanical equipment of large modern steam power stations. In addition, they should have had some experience of the preparation of designs and specifications for new plant and investigations and tests in connection therewith, while Corporate Membership of the Institution of Mechanical Engineers is also desirable. The commencing salary will not be less than that given in the N.J.B. Schedule "C," for Grade 2, Class "CX" headquarters staff. The selected candidate will be required to pass a medical examination and to join the Company's pension fund.

Applications, in writing, giving age and full particulars of education, technical qualifications, engineering training and power station experience, should be sent to the Staff Manager, Imperial Chemical Industries Ltd., General Chemicals Division, Cunard Building, Liverpool 3, quoting reference P/1 or P/2 as appropriate. (A 508)

KUWAIT OIL COMPANY requires TECHNICAL INSTRUCTORS for Training Division in Kuwait as follows:

(a) 1 Technical Instructor in General Engineering Fitting.

(b) 1 Technical Instructor in Engine Fitting.

(c) 1 Technical Instructor in Diesel Fitting.

(d) 1 Technical Instructor (Electrical).

Applicants for (a), (b) and (c) must have full recognised mechanical engineering apprenticeships and for (d) a full recognised electrical apprenticeship. Ordinary National Certificate is required in all cases and at least 5 years' experience as a master tradesman. Preference given to candidates with previous experience as instructors. Age 32-40. Salary in all cases starting £710 per annum clear plus generous allowances, pension scheme and kit allowance.—Write for application form, giving personal details and quoting appropriate reference: (a) K.1554; (b) K.1562; (c) K.1556; (d) K.1555 to Box M/26 at 191 Gresham House, E.C.2. (A 510)

REQUIRED for Middle East. PLUMBER JOINTER experienced in jointing paper insulated cables, lead covered and armoured, up to 11 kV.—Apply, stating age and experience. Forward copies of testimonials or state names to whom we may apply to Box No. 1911, Electrical Times. (A 511)

SENIOR ENGINEER required to take charge of section engaged in the design of power transformers (1 to 100 kVA), in expanding company wishing to enter this field. Applicants should have wide experience in the design and manufacture of transformers, and should preferably possess an Engineering Degree. House may be available later.—Write, stating qualifications, experience and salary required, to Box No. 1919, Electrical Times. (A 556)

SENIOR ELECTRICAL DRAUGHTSMAN required for modern London office; preferably with experience of power distribution and lighting installations as applied to chemical and oil refinery plants. Qualifications to H.N.C. standard. Good conditions, 5-day week, pension scheme.—Write full particulars, age, qualifications and experience to Box No. 6017, c/o Charles Barker and Sons, Limited, 31 Budge Row, London, E.C.4. (A 454)

SENIOR ELECTRICAL ENGINEER required for Middle East duty by large oil company. Honours degree and/or A.M.I.E.E. essential, together with administrative experience and considerable technical practice in the layout, operation and maintenance of h.t. and l.t. systems from generation to end use. Desirable age limit 40. Generous allowances in addition to salary, pensionable post; biennial (paid) home leave.—Write, quoting No. 206, to Box No. 6077, c/o Charles Barker and Sons, Ltd., 31 Budge Row, London E.C.4. (A 555)

TRANSFORMER CONTRACT ENGINEERS are required by the English Electric Co., Ltd., at Stafford. Preference will be given to applicants who have served a recognised apprenticeship in heavy electrical engineering and who are of at least H.N.C. standard.—Please write, giving full details and quoting reference 396C, to Central Personnel Services, English Electric Co., Ltd., 24-30 Gillingham Street, London S.W.1. (A 551)

WORKS MANAGER and ASSISTANT WORKS MANAGER required by electric lamp manufacturing company in India. Applicants must have all-round experience of incandescent lamp and fluorescent tube manufacture experience also desirable, but not obligatory. Applicants preferably should be single. Four years' agreement with renewal clause. Salary and allowances approximate to £1,800 per annum Works Manager, and £1,350 per annum Assistant Works Manager, rising by £90 per annum yearly.—Write, stating age and giving full particulars of training and experience, to Box Z.P.37, Deacon's Advertising, 36 Leadenhall Street, London E.C.3. (A 542)

APPOINTMENTS WANTED

70 ACCOUNTS opened in a year. Personable ex-R.A.F. S/Leader, Signals, seeks sound SALES APPOINTMENT. Single, car, mobile, located in London.—Box No. 1925, Electrical Times. (A 570)

WORK WANTED

A.C. and d.c. Motor Rewinds and Repairs. Prompt service, fully guaranteed. Edgware 5566 (4 lines) —Service Electric Co., Ltd., Stanmore, Middx. (A 19)

CONDENSER AND TRANSFORMER CASES. Special boxes and covers. Sheet metal and press work for the electrical trade. May we quote you? A.I.D. approved. —Conway-Tolhurst Ltd., Airport, Cardiff. (A 326)

WELDING WORK WANTED. Large capacity available in all materials and methods. Keen prices and good workmanship. Difficult jobs our speciality. A.I.D. approved.—Conway-Tolhurst Ltd., Airport, Cardiff. (A 325)

WANTED

A.C.-D.C. MOTORS, STARTERS, complete changeover installations, etc.—A.A. Electrical Co., Ltd., 67 Rothschild Road, Chiswick Park, W.4. Tel.: Chiswick 6105. (A 11)

SIX Hoffman or similar RLS.24 LIGHT ROLLER JOURNALS, suitable for 480 r.p.m., 750 h.p. load; triple zero fitting.
George Cohen Sons and Co., Ltd., 58 Wood Lane, London W.12. (A 544)

TO CONDUIT FITTING MANUFACTURERS. Large manufacturing, distributing house is interested in a small manufacturer of Conduit Fittings. Purchases paid for weekly, or might be interested in taking financial interest.—Box M.8465, The National Publicity Co., Ltd., 358 Strand, London W.C.2. (A 558)

£50,000

Immediate cash available for purchase of New Ball and Roller Bearings, all types. Steel Balls and Rollers. Top prices paid. Purchases from Traders only.

CLAUDE RYE BEARINGS

895-921 Fulham Road, London, S.W.6
RENown 6174 (20 lines) (A 328p)

WANTED. D.C. and A.C. ball-bearing MOTORS, MOTOR GENERATOR SETS, DYNAMOS and ALTERNATORS.—Full details to Britannia Manufacturing Co., Ltd., 22-26 Britannia Walk, London, N.1. (A 7)

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. and H. Cooper Ltd., 176 Brady Street, Bethnal Green, E.1. (A 1)

WANTED. Large quantity of 4-in. outside diameter TUBES from the dismantling of old Babcock Watertube boilers. Best prices paid. Prepared to purchase Babcock and Wilcox Water-tube Boilers for dismantling. —Apply, giving full details to Midland Iron and Hardware Co., Cradley Heath, Staffs. (A 3)

WANTED, ROTARY CONVERTORS, any size.—Universal, 221, City Road, London, E.C.1. (A 9)

FOR SALE

CABLES & WIRE

TINNED STEEL ARMATURE BINDING WIRE. All sizes from 14 s.w.g. to 30 s.w.g. supplied in coil or on reels.—Frederick Smith and Co., Wire Manufacturers Ltd., Caledonia Works, Halifax. (A 22)

2,000 YARDS 0·04 four-core P.I.L.C. and S. CABLE: any lengths cut. Immediate delivery.—E. M. Tatton and Co., Ltd., Kew Bridge, Brentford. Eal. 3155. (A 524)

GENERATING PLANT

ALTERNATING SET for sale. Motor driven on baseplate. Input 70 h.p., 1,500 r.p.m., 440 d.c.; output 400 V, 1 phase, 50 cycles, 36 kVA. Starter panel with shunt regulator and a.c. voltmeter.—F. J. Edwards, Ltd., 359 Euston Road, London N.W.1. Euston 4681. (A 559)

DIESEL ALTERNATOR SETS in stock up to 500 kVA. 400/440 V, 3-phase, 50 c/s, 4-wire. Detailed stock list post free on request.—Thos. W. Ward Ltd., Albion Works, Sheffield. Tel. 26311 (ext. 347). (A 482)

MOTOR GENERATOR SETS built to customers' requirements from new and/or modern reconditioned machines. Guaranteed for twelve months. Good deliveries. Competitive prices.—Inquiries to Thos. W. Ward, Ltd., Albion Works, Sheffield. Tel. 26311 (ext. 347). (A 483)

MOTOR GENERATOR SETS. 625 kVA, 500 kW, 400/3/50, 750 r.p.m. reversible MOTOR GENERATOR SET, comprising revolving field synch. motor, 400/3/50, open type, fitted bell shields and direct-coupled exciter, single pedestal R.O.B., direct-coupled 500 kW, 480/550 V d.c. generator, compound interpoler, suitable 3-wire operation. Mounted in tandem on C.I. bedplate, with guard rails and static balancer.

A.C./D.C. MOTOR GENERATOR SET by B.T.H., comprising 92-h.p. slip-ring motor, 200/3/50, running at a speed of 580 r.p.m., direct coupled to one 60 kW, 100 V, 600 amps d.c. generator. Protected type frame with end shield ring oil bearings. Mounted on channel bedplate —George Cohen, Sons and Co., Ltd., Wood Lane, London W.12. Tel.: Shepherds Bush 2070 and Stanningley, near Leeds. Tel.: Pudsey 2241. (A 531)

SPECIAL OFFER

100 kW 3 WIRE D.C.

MOTOR GENERATOR SET

Brief Specification

100 kW direct-coupled Motor Generator Set, on combined baseplate, comprising new 150 h.p. "Brook" screen-protected slip ring motor, 400/440 V 3-phase, 50 cycles, direct-coupled to modern 100 kW "Mawdsley" drip-proof compound wound generator, 440/220 V, 3-wire, 960 r.p.m.; ball and roller bearings throughout. With oil-immersed a.c. control gear, generator switchboard incorporating static balancer.

Further details and price on request.

Immediate Delivery

We specialise in building Motor Generator Sets to suit individual requirements.

THOS. W. WARD LIMITED

Albion Works, Sheffield

Phone 26311 (ext. 347) Grams "Forward, Sheffield"

(A 480p)

ENGINEERING PLANT & MATERIALS

500,000

NEW BALL RACES, ROLLER, THRUST AND TIMKEN RACES IN STOCK. LISTS AVAILABLE.

CLAUDE RYE BEARINGS

895-921 Fulham Road, London, S.W.6
RENown 6174 (20 lines) (A 329p)

ALUMINIUM ALLOY, new flat sheets, size 6 ft x 3 ft x 24 gauge. Price per lb. ex Works; 1 cwt. 3/6, 5 cwts. 3/4 per lb.; 10 cwts. 3/2 per lb.; 1 ton 3/- per lb., 2 tons 2/11 per lb.; under 1 cwt. 25/- per sheet. Approximate weight of each sheet 6 lbs. Available ex stock.—D. McMaster and Co., Ltd., Mount Bures Works, Mount Bures, Essex. Tel.: Bures 351/2. (A 445)

HEAVY GAUGE STEEL CONDUIT, 2,000 ft by ¾in. B.E., 1,000 ft by 1¼ in. B.E., 1,000 ft by 1 in. galv. Price £160 lot. Buyer collect.—Redhill 3408. (A 568)

DOMESTIC APPLIANCES

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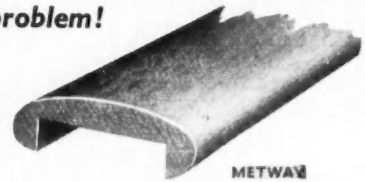

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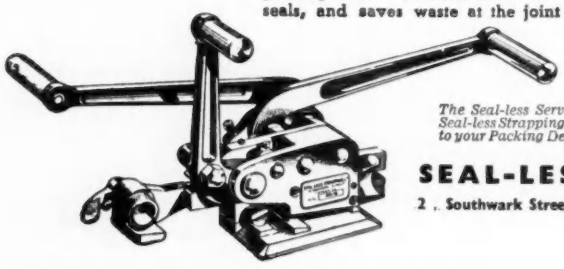

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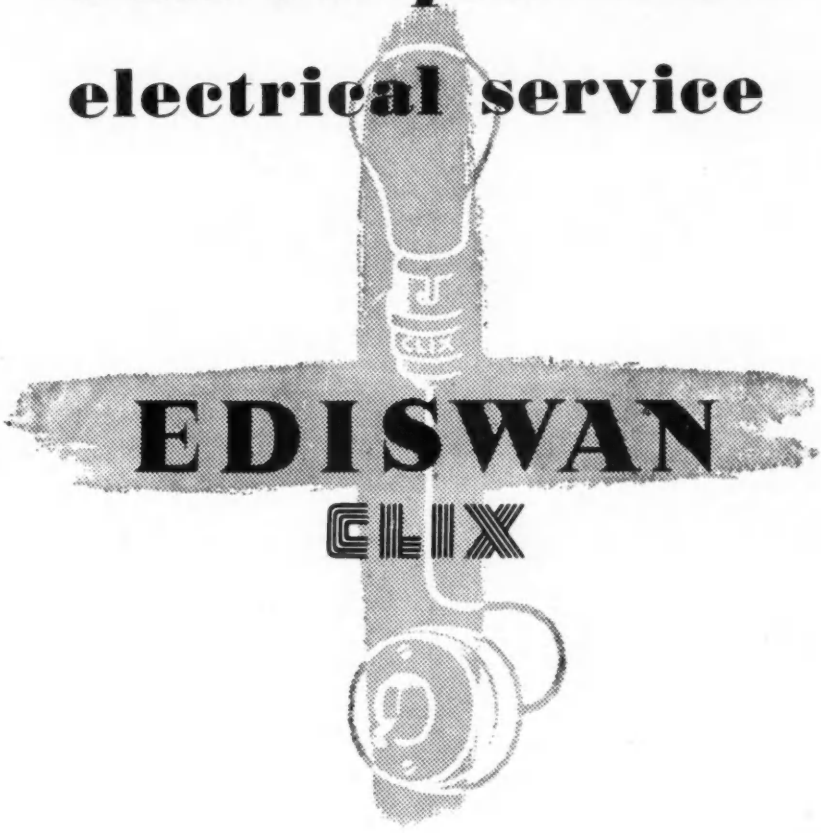

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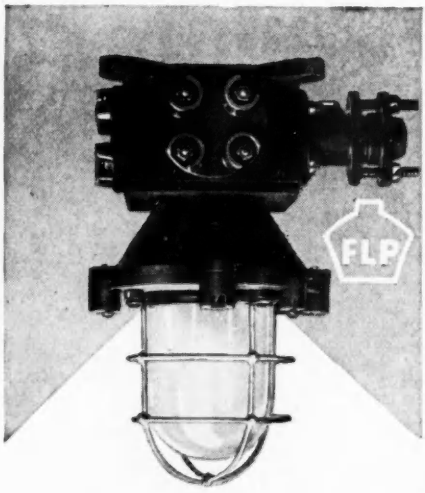

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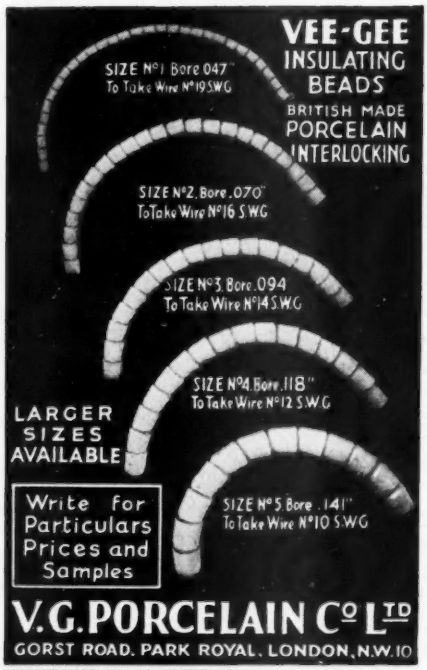
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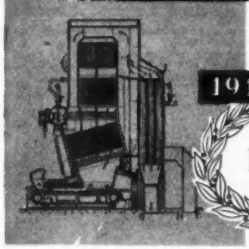

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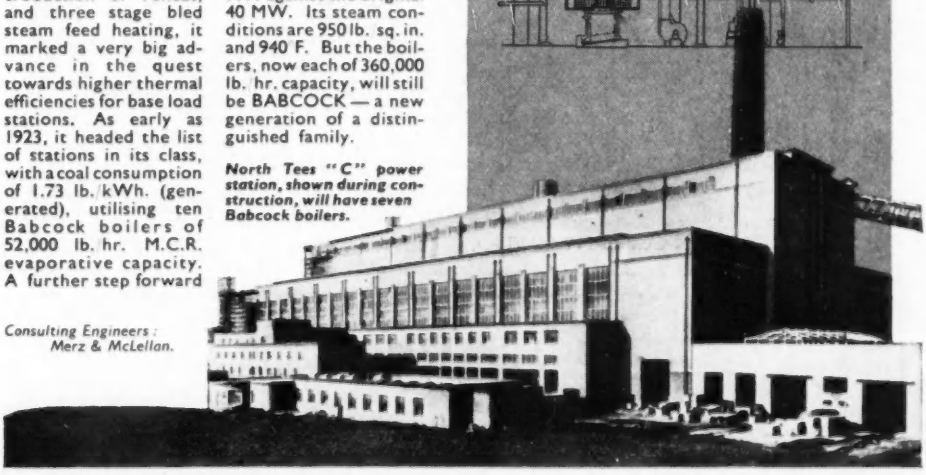

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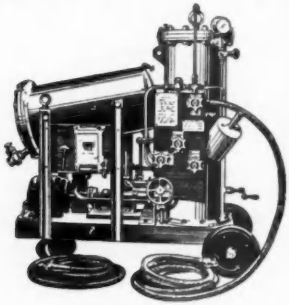

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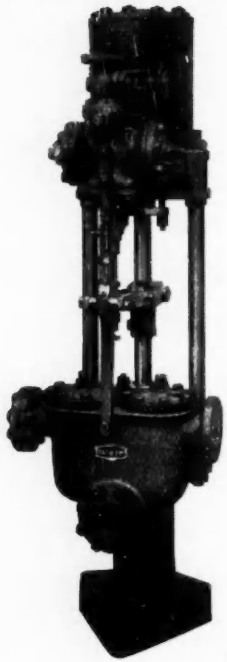

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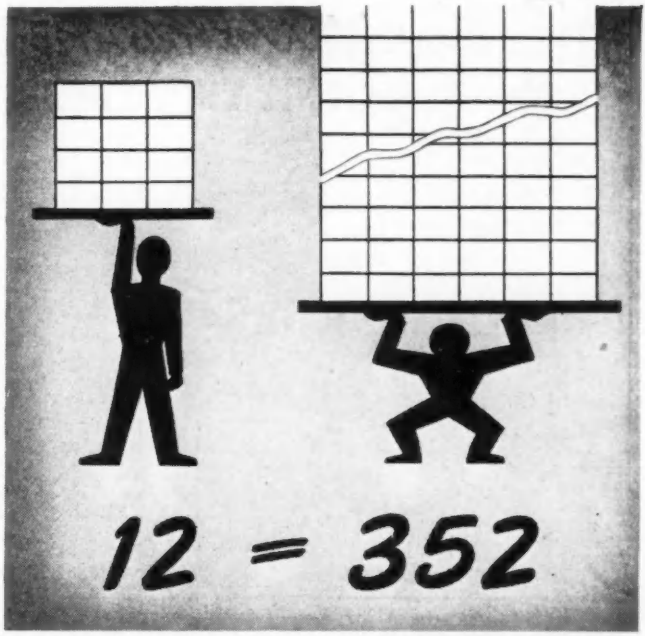

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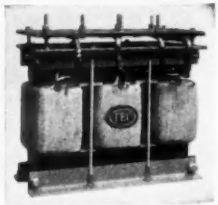

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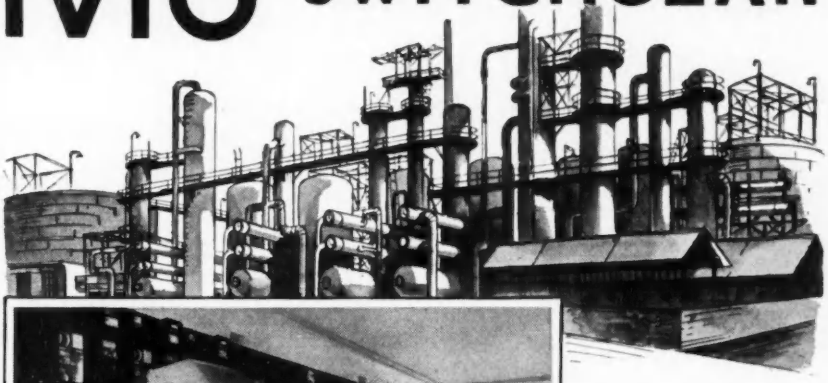

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PICTURE ON LEFT ILLUSTRATES A NUMBER OF THE UNITS ISOLATED.

PICTURE ON RIGHT ILLUSTRATES A HAND OPERATED, 415 VOLT, 3-PHASE, 4-WIRE, 25 MVA METALCLAD SWITCHBOARD.

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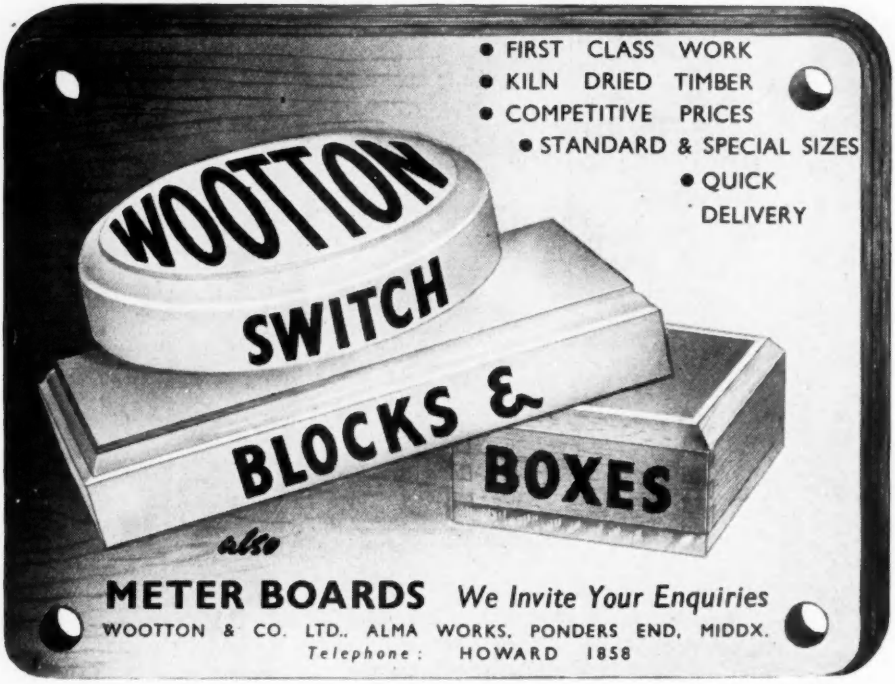

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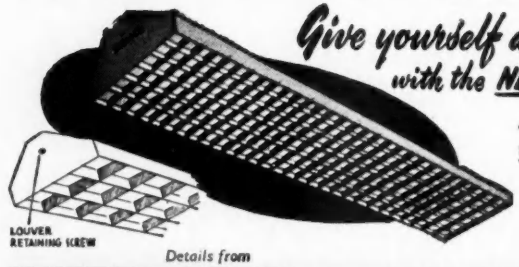

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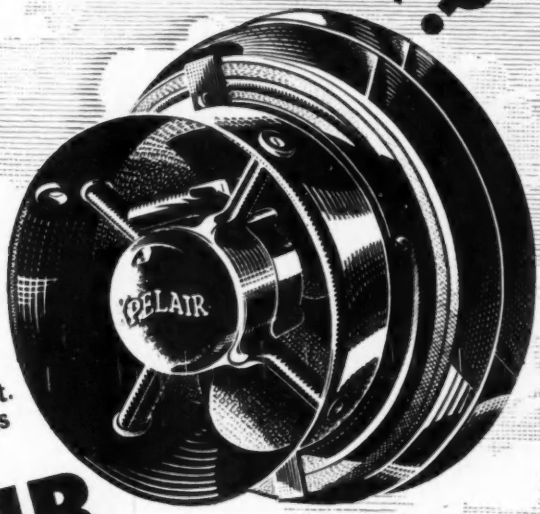

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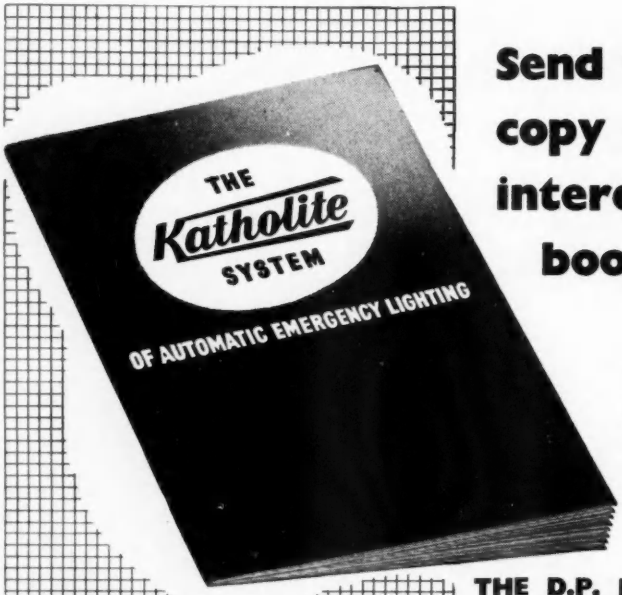

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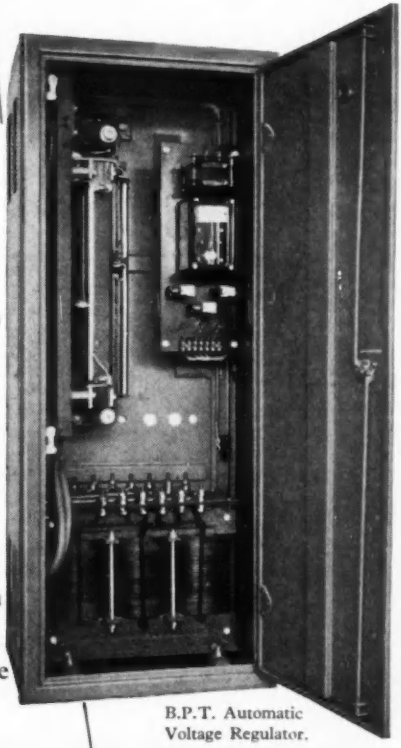

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Where is the home of Calypso?

✷

What are the only French possessions in North America?

✷

Where do they export Carobs?

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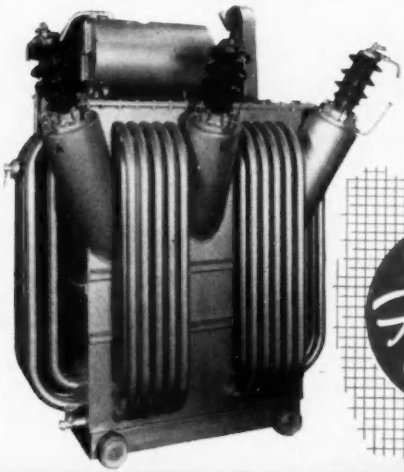

The illustration shows a 400 kVA 22kV transformer for service abroad

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The drawing shows the sectional arrangement of a single effect Evaporator.

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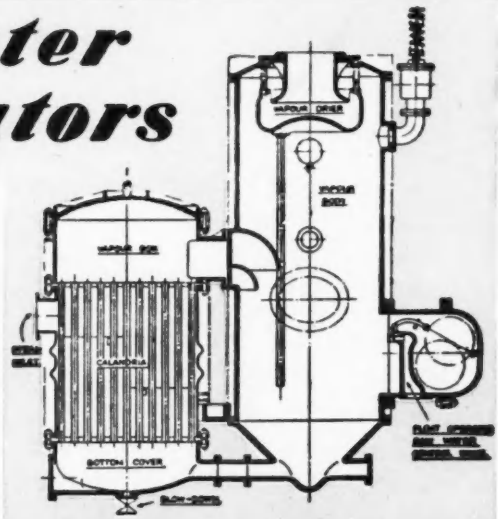

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